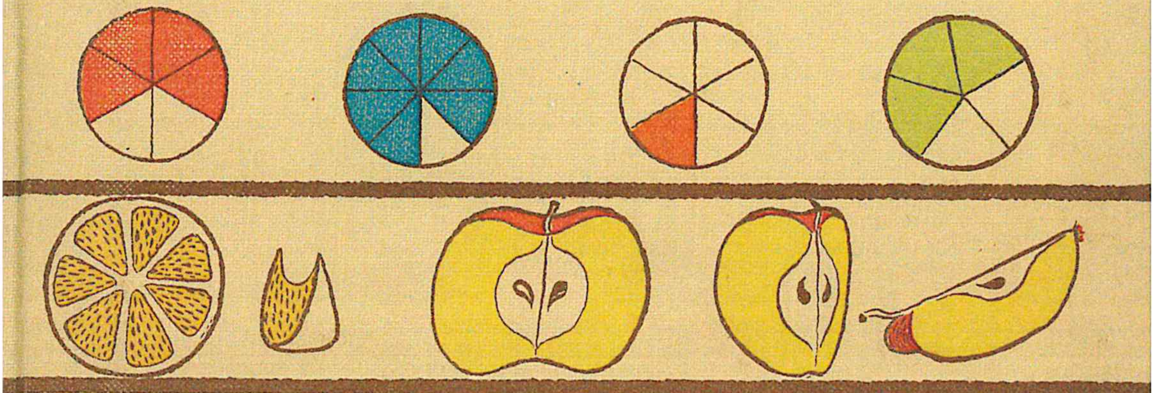

THE SCRIBNER

ARITHMETIC

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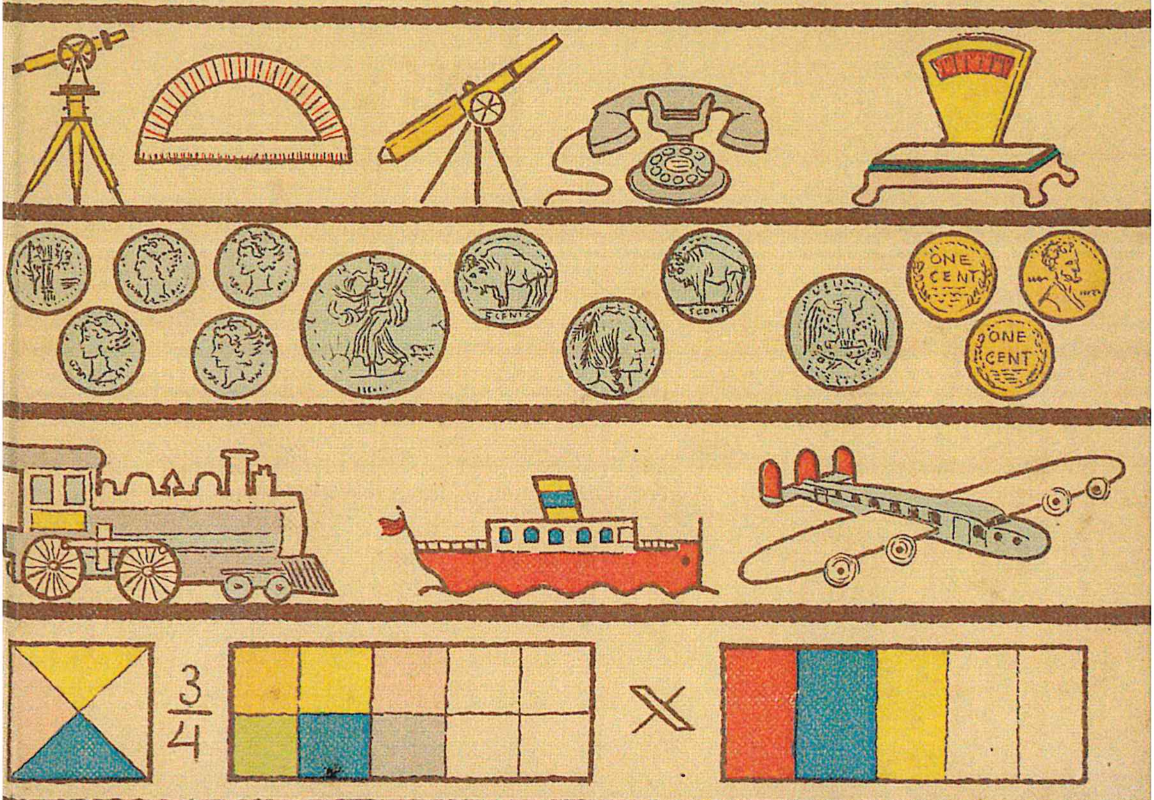

THE
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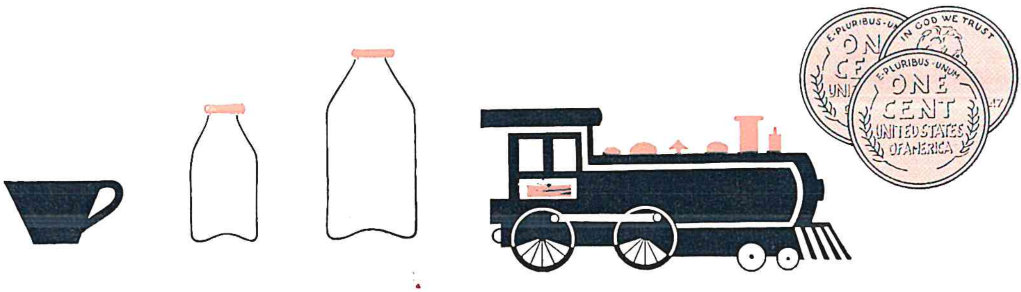
Arithmetic

BOOK 5

THE SCRIBNER

by RICHARD MADDEN LESLIE S. BEATTY

WILLIAM A. GAGER



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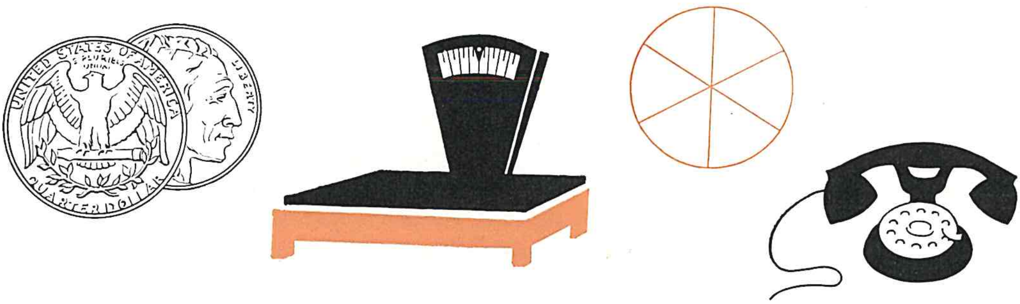
BOOK 5



CHARLES SCRIBNER'S SONS

CONTENTS

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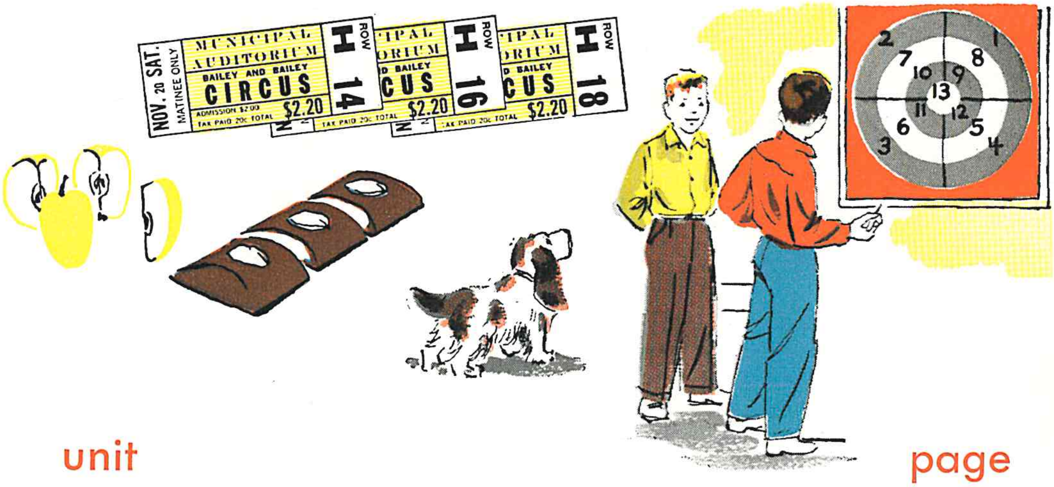
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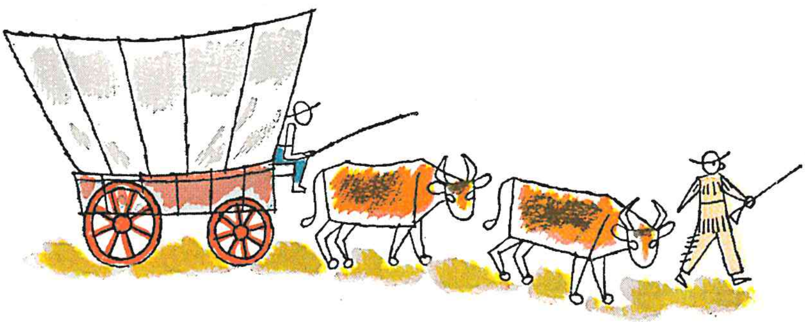


A NOTE ABOUT THE TEACHER'S GUIDES

A TEACHER'S GUIDE to aid in preparing each day's work is available for each book in *The Scribner Arithmetic* series, *Books 3–8*.

The Guide material, which has grown out of the experience of many teachers, provides effective procedures and methods.

The Guides contain (1) facsimiles of the text pages with answers printed in red, (2) specific teaching suggestions for every text page, with emphasis on development of vocabulary, (3) additional practice material, and (4) suggestions for enrichment activities. (In the Guides for *Books 3–6*, there is a section describing concrete and graphic materials and games which help to make arithmetic meaningful to children.)

In many cases the development of the basic concepts is given in great detail to assist the teacher in helping slow learners. The enrichment material may, of course, be offered to all pupils, but it is provided primarily for those who think and work fast.

To the busy teacher, the Guide is an invaluable aid:

1. It gives an overview of the general aims, principles, and organization of the arithmetic program. A chart showing the grade placement of content in the series is also included.
2. It furnishes a ready reference to tried and proved methods and procedures.
3. It enables the teacher to provide for the wide range of individual differences found in almost every class.

ACKNOWLEDGMENTS

The authors wish to thank especially Jane Genin Plenty and Anna C. Paxton who carefully read the entire manuscript and made many comments that were invaluable.

THE
SCRIBNER

Arithmetic

BOOK 5

UNIT 1

ADDING AND SUBTRACTING

ARITHMETIC IS EVERYWHERE

Can you think of anything that has no arithmetic about it? Does nothing about it even suggest arithmetic?

Jim says, "A cloud." Can you know all about a cloud without using arithmetic?

Martha says, "A shadow." Can you answer all the questions anyone might ask about a shadow without using any arithmetic?

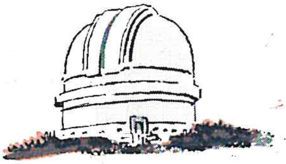
David had a hard time thinking of something. He tried water, air, space, the moon, and electricity. But somebody thought of some arithmetic about all of them. Can you think of some arithmetic about each of them?

When everyone was about to give up, Peggy cried, "I have one. There's no arithmetic about green! You can't weigh it. You can't measure it. You can't take its temperature. You can sell a piece of cloth, but you can't sell its greenness."

Jim asked Peggy slyly if she is thinking of a light green or a dark, heavy green. "If it's paint," he asked, "how was it mixed?" "If it's the color of a flower, how much plant food was needed to make it a dark green? Is it somewhat yellow because it got just a little water?"

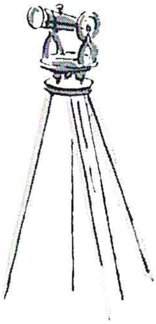
Is there anything that can have no arithmetic? It can't cost anything. It can't be any place. It can't weigh any amount. It is neither hot nor cold. You can't count it.

If arithmetic isn't everywhere, it is nearly everywhere.



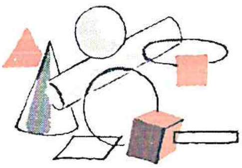
MEASURES, NUMBERS, LOCATIONS, AND SHAPES

1. How many different kinds of measures can you name? Would you include tire pressure, shoe sizes, packages, and vision charts? What else would you include?



2. How big is the biggest number? Could you write a number as long as your room? Could you read it?

3. Do you know who lives one block east and one block south of you? or one mile east and one mile south of you? Does arithmetic help you locate places? What is a map? a globe?

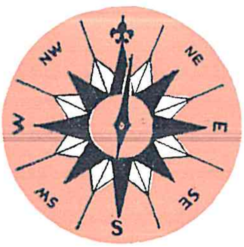


4. Name all the shapes you can. What is a square? a circle? a triangle? a square corner? an oval? a sphere? a cylinder? a tube?

What is a pattern? a design? a drawing?

5. How many of these signs do you know?

$+ \quad - \quad \times \quad \div \quad ' \quad '' \quad \overline{)\quad} \quad {}^\circ$



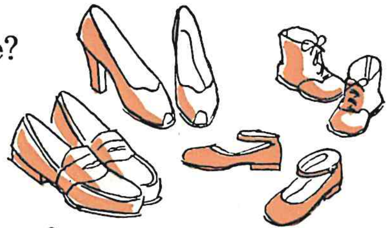
6. Read these abbreviations: yd., in., mo., ft., qt., pt., lb., gal., oz., yr., mi., min., hr., sec.

7. Name all the arithmetic words that the picture below makes you think of:

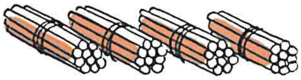
DIGITS AND THEIR PLACE VALUES

1. Our number system has how many digits? Did you count the zero? The digits are **0, 1, 2, 3, 4, 5, 6, 7, 8, 9.**

2. Write "three apples," or "three chairs," or "three books." If you just write 3, can you tell whether or not it is apples, or chairs, or books?



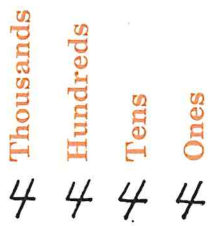
3. How many pairs are there here? If you just write 4, can you tell that it means 4 pairs? Four pairs equal 8, but does 8 always mean 4 pairs?



4. Each of these groups has ten in it. Can you use two digits to write 4 tens and tell why the number means 4 tens?

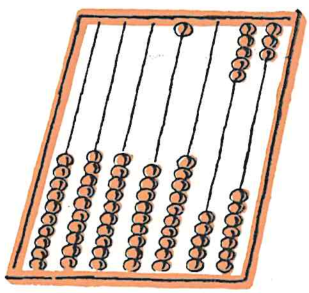
5. Is it easier to write 4 tens or 4 pairs? 6 tens or 5 dozens?

• Our number system is a tens system. A tens system is a **decimal** system. Each place in a number has a name. The name tells how many the digit means when it is in that place. →

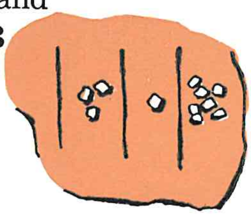


6. Which 4 in 4444 means the most?

7. Long, long ago, before people used the decimal system, they made numbers with pebbles on a counting table or with beads on a counting frame.

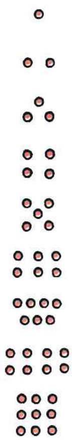


Why do the pebbles stand for **317**? Can you see **1053** in the beads?



Why is a store counter called a counter?

PUTTING THINGS AND GROUPS TOGETHER



0
1
2
3
4
5
6
7
8
9

1. What is the number for *not any*?

2. What number stands for a single object?

3. The numbers come in order. Zero is the first number. One comes next. Two comes next, and then three. Name the numbers through 9 in their order.

4. Is the name of a group which is one more than another group, the next number? Any group and 2 more are what?

5. Any number and zero more are how many? 7 and 0 are _?_. 4 and 0 are _?_. 35 and 0 are _?_. 150 and 0 are _?_.

PRACTICE IN ADDITION

Add. Use folded paper.

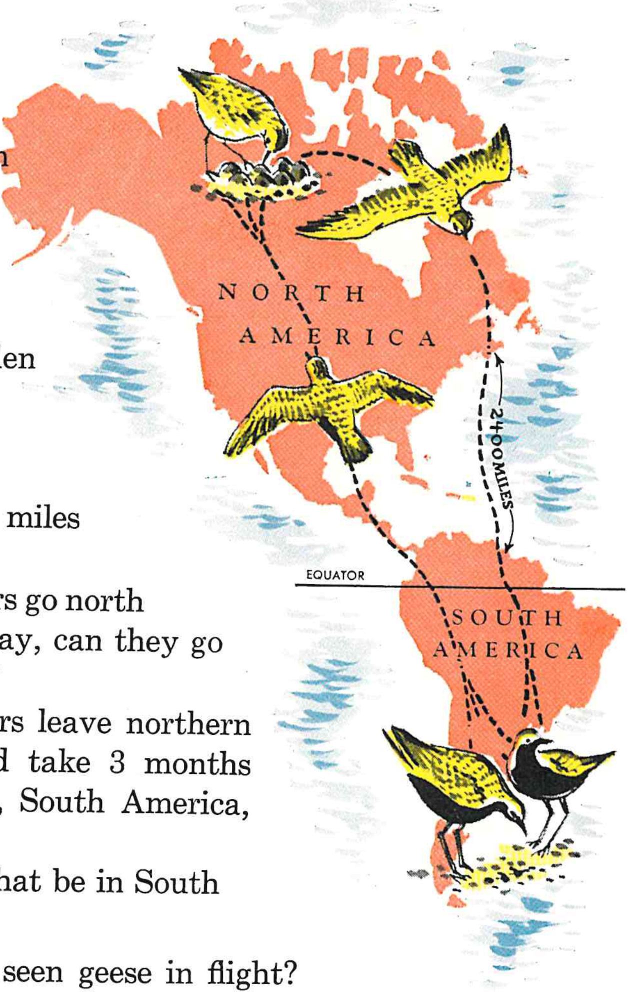
1.	3 3	4 5	9 9	8 2	7 7	9 2	5 3	8 8	3 4	7 2
2.	8 5	3 9	6 2	9 5	3 7	9 4	5 6	6 8	7 5	4 6
3.	8 4	7 6	3 8	7 9	2 6	9 3	4 7	6 9	7 3	8 6
4.	4 9	8 3	7 8	3 6	5 9	6 4	2 7	5 8	9 7	6 5
5.	9 6	5 7	9 8	7 4	3 5	8 7	6 3	4 8	6 7	8 9

ARITHMETIC HELPS US UNDERSTAND NATURE

Migration of the Golden Plover

1. In which season do birds go south? north?

2. Which season is it now in South America?



3. Does the golden plover ever stay in a place during the winter season? Tell why not.

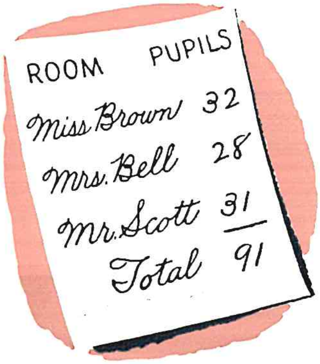
4. Sometimes golden plovers fly 2400 miles over water without stopping. Could they do that in 2 days at 40 miles an hour?

5. If golden plovers go north about 200 miles each day, can they go 8000 miles in a month?

6. If golden plovers leave northern Canada in August and take 3 months to arrive in Patagonia, South America, when will they arrive?

What season will that be in South America?

7. Have you ever seen geese in flight? In what shape were they grouped? Does this help them from getting lost?



▶ WHAT IS ADDITION?

1. You have different groups. You want to know **how many there are all together.** Can you find out by adding the numbers?

2. You have the costs of different things. You want to know the **total cost.** What do you do to get it?

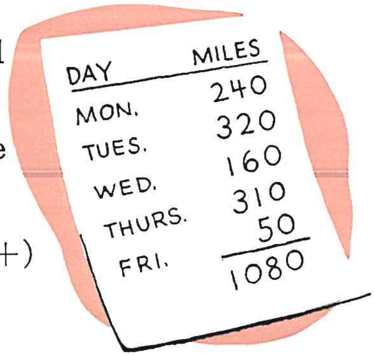
3. You have numbers for things that happened at different times. You want to know the **total amount.** How can you find it?

Think of additions that you have made, or that you might need to make. Tell them to the class.

4. Do you remember these addition names?

- The numbers you add are called the **addends.**

- The answer is the **sum.** It may be called the **total** or **amount.**



- The sign for addition (+) is called **plus.**

$$\begin{array}{r} 8 \\ +5 \\ \hline \end{array}$$

$$\left.\begin{array}{r} 12 \\ 34 \\ 23 \end{array}\right\} \text{ADDENDS}$$
$$\begin{array}{r} \hline 69 \end{array} \text{ SUM}$$

Are your digits easy to read? Copy these.

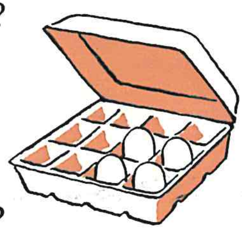
0 1 2 3 4 5 6 7 8 9

WHEN DO YOU SUBTRACT?

1. Suppose you have two groups of things or measures of two things.

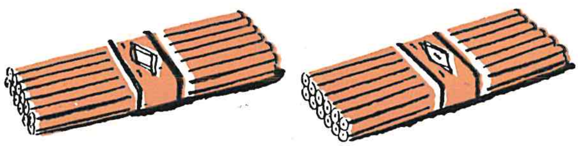
Ask some problems which **compare** them by subtraction. Did you ask how much heavier? what is the difference? how many more? how much farther? how much cheaper?

2. You want to know **how many are left.** You have a number of things. Some may be lost, be spent, be given away, be eaten, and so on. How many are left?



Ask problems which have the question, "How many are left?"

3. You need more of something. You already have some. **How many more are needed?** More pounds? More quarts? More pages to read? More people? More pencils? More money?



Ask problems with questions like those above.

4. Do you remember these subtraction names?

Remember that the subtrahend is *below* the minuend. What does *sub*marine mean? *sub*way?

minuend → 25
subtrahend → 12
difference → 13

- The sign for subtraction (−) is called **minus.**
- Another name for **difference** is **remainder.**

Jane has some cats and canaries. All together they have 18 feet and 6 heads. How many cats does Jane have? How many canaries?

Answer: three of each.

THE SUBTRACTION FACTS

1. How many is zero? If you have a number of things and take zero of them away, how many are left?

2. Facts with subtrahends of 1 are nearly as easy. The answer is always how many less than the minuend?

3. This time you must think back 2. Use folded paper.

2	6	3	8	11	7	10	5	9	4
−2	−2	−2	−2	−2	−2	−2	−2	−2	−2

4. Tell what you get when you subtract these:

a.

3	4	5	6	7	8	9
3	4	5	6	7	8	9

b.

4	5	6	7	8	9	10
3	4	5	6	7	8	9

PRACTICE IN SUBTRACTION

Subtract. Use folded paper.

	a	b	c	d	e	f	g	h	i
1.	10	13	14	11	17	15	8	12	14
	3	8	7	5	9	6	5	6	9
2.	11	12	16	10	11	10	9	11	7
	9	5	8	7	3	6	3	8	2
3.	15	12	10	15	11	13	10	14	8
	9	7	4	8	6	4	9	6	3
4.	12	11	8	10	12	18	9	17	14
	3	7	6	5	8	9	4	8	5
5.	9	11	12	13	9	14	13	16	7
	6	4	9	7	2	8	5	7	3
6.	13	7	9	12	10	9	16	15	13
	6	4	7	4	8	5	9	7	9

ARITHMETIC IS USED AS WE TRAVEL

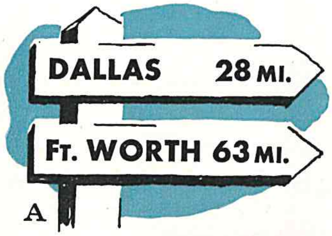
Answer the questions below by using the Figures *A*, *B*, *C*, *D*, and *E*:

A. How many miles farther is Ft. Worth than Dallas?

B. Did the gasoline cost more or less than 30¢ a gallon?

C. When does Flight No. 4 leave Chicago and arrive in St. Louis? How long does the trip take?

D. How much cheaper is a round-trip ticket than two one-way tickets?



A

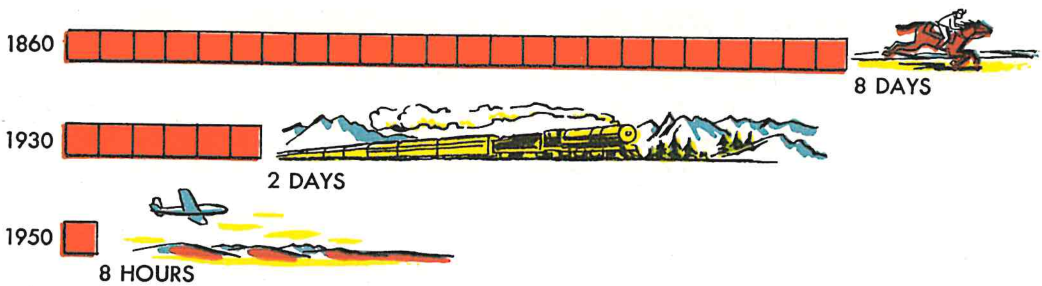
B

C

FLIGHT NO.	LEAVE CHICAGO	ARRIVE ST. LOUIS
1.	8:10 AM	9:33 AM
2.	10:40 AM	12:03 PM
3.	4:45 PM	6:08 PM
4.	6:00 PM	7:23 PM

D

E MISSOURI TO CALIFORNIA



E. How many times as long did it take a letter to go from Missouri to California in 1860 as it did in 1930? in 1950 by air mail?

Make some other problems about travel that use arithmetic.

THE ANSWER STRIP SAVES MANY HOURS OF TIME

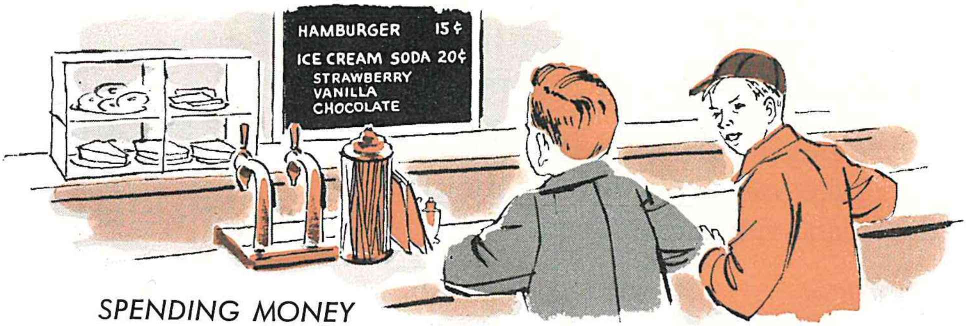
There are some things you need to know very well. You use addition and subtraction facts so often that you need to be able to think the answers and write them as fast as you can.

You learn the answers first by thinking about them and figuring them out. Then you can learn to think them quickly.

Your teacher will say some number questions. You will write the answers. Your teacher will say the questions slowly the first time, and then go faster later as you know the facts better. At first she may say one every 7 or 8 seconds, and later one every 4 seconds.

THE TEACHER SAYS:		YOU WRITE:	
No. 1:	4 and 5 are	9	
	6 and 6	12	
	8 and 3	11	
	7 and 7	14	
	6 and 4	10	
No. 6:	8 and 7	15	(*You don't know, so*
	9 and 6	—	← *you make a line.*)

The teacher will next read the facts (questions and answers) to help you check. Write the fact when you have an answer wrong or left out. With 5 minutes a day of practice like this, you'll soon know all the facts. First you study the hard ones. Then use the answer strip. (See bottom page 11.)



SPENDING MONEY

Bob and Joe have a few coins in their pockets. Together they have a quarter, 3 dimes, a nickel, and 4 cents.

1. How much money do they have?

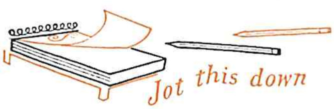
2. Can they buy two hamburgers?

3. Can they buy two sodas?

4. How much do two hamburgers and two ice-cream sodas cost?

5. How many more cents do they need to buy two hamburgers and two sodas?

6. Joe says, "Let's each take a hamburger and you take the soda." Can they do that?



Is there a sales tax in your state?

This book is written for children who live everywhere in the United States of America. Some things are taxed in some states that are not taxed in other states. The amounts may be different too. So you will figure all answers in this book without a sales tax unless you are asked to do otherwise.

QUESTIONS FOR THE ANSWER STRIP

Read down, "5 and 9"   Read down, "13 minus 6"

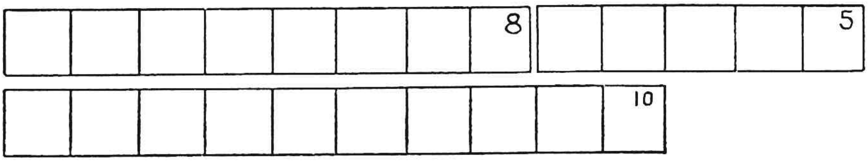
(1)	(6)	(11)	(16)	(1)	(6)	(11)	(16)
5 + 9	8 + 9	9 + 4	7 + 9	13 − 6	17 − 8	17 − 9	13 − 8
7 + 6	9 + 6	7 + 8	5 + 8	14 − 8	15 − 9	15 − 8	14 − 6
9 + 8	7 + 5	9 + 7	8 + 7	12 − 7	16 − 7	14 − 9	16 − 9
6 + 9	4 + 9	8 + 5	9 + 5	14 − 5	11 − 3	13 − 5	13 − 4
5 + 7	8 + 6	6 + 8	6 + 7	13 − 9	13 − 7	15 − 6	15 − 7

LEARNING DIFFICULT FACTS

Thinking about relationships to ten may help you remember the difficult addition and subtraction facts.

ADDITION

1. $8 + 5 = ?$ You know that $8 + 2 = 10$.
You know that $2 + 3 = 5$.
Then $8 + (2 + 3) = 10 + 3 = 13$.
Or $8 + 5 = 10$ and 3 or 13.



2. Think the answer to each of these questions in the same way:

$7 + 5$ $9 + 6$ $4 + 9$ $8 + 6$ $9 + 7$ $5 + 8$ $9 + 8$ $5 + 9$

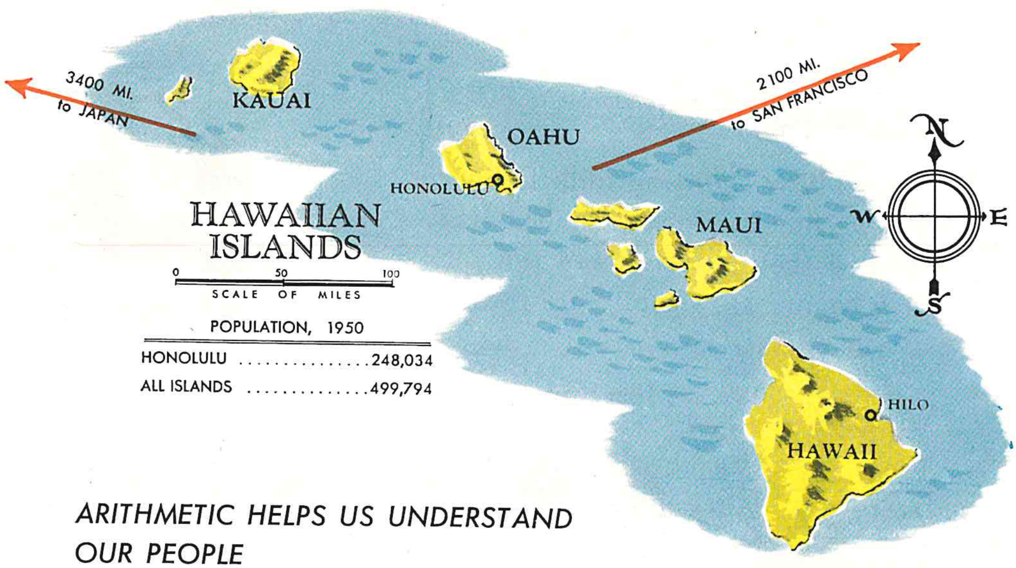
SUBTRACTION

3. How do you think about $13 - 5$? Carol learned the answer by thinking $13 - 3$ is 10, -2 is 8. She knows it now without thinking.

Paul says he learned that $8 + 5 = 13$, so $13 - 8 = 5$ and $13 - 5 = 8$.

How do you think out subtractions that are still hard for you?

Each time a fact causes you trouble, think the answer until you know it. Then practice so that you can keep up with the answer strip speed.



ARITHMETIC HELPS US UNDERSTAND OUR PEOPLE

1. How many islands are shown above? Which is the largest?

2. How many people lived in Honolulu in 1950? Was this about half as many as there were on all the islands?

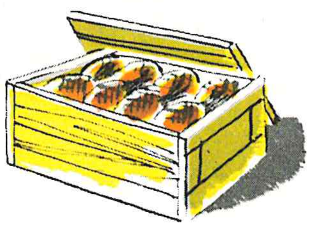
3. Which island do you think has the most people? Why?

4. About how far is it from the Islands to San Francisco? to Japan?

5. What is meant by mid-Pacific? Are the Hawaiian Islands closer to America or to Asia?

6. Which direction are the Islands from San Francisco?

7. During one year enough sugar was made so that each person in the Hawaiian Islands could have had 2 tons. What do you think was done with the sugar?



8. Find facts about another one of Hawaii's chief products.

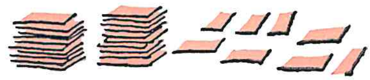
CARRYING

Judy is counting milk tickets for two first grade rooms. She has stacked them in groups of ten for each room. How many are there?

A	*B*	*C*
	1	
26	26	26
28	28	28
14	54	54
4		
54		

Miss Smith's

Mrs. Wilson's



Explain Examples *A*, *B*, and *C*.

Judy could use any one of the 3 ways to find the total.

Write the carry digit, as in Example *B*, when you have long columns. It makes checking easier.

PRACTICE

Copy and add the examples below. See how well you can write them.

	a	b	c	d	e	f	g	h
1.	35	14	72	13	75	37	26	21
	26	29	74	18	15	14	38	95
2.	19	24	48	36	56	63	19	26
	37	56	13	39	82	64	89	25
3.	49	68	17	92	34	58	29	48
	45	24	86	81	67	12	63	27
4.	17	46	58	13	28	74	39	59
	43	81	25	67	69	53	54	26
5.	73	68	57	58	95	77	35	26
	89	36	39	71	23	28	59	87

ADDING COLUMNS

When there are more than two digits in a column, you must make more than one addition.

First you add down. You say the whole addition this way: "3 and 5 are 8. 8 and 6 are 14. Put the 4 in ones' column. Then write the ten." Soon you will just say this, "3, 8, 14." Later you will just imagine the unseen 8 and see the 6 and write 14. Try to do that now. Do you feel the 8 on the tip of your tongue?

$$\begin{array}{r} 3 \\ 5 \\ 6 \\ \hline 14 \end{array}$$

1. What are the unseen numbers in these? The unseen numbers in (**a**) and (**b**) are shown.

a	b	c	d	e	f	g	h
2	3	5	3	4	1	5	3
7(9)	4(7)	3	2	2	3	4	5
5	8	7	8	9	7	6	5

When the first two digits add to 10 or more, you must then use a fact with a 2-place number in it.

The unseen number is 13. $13 + 4 = 17$ is the next fact you need.

$$\begin{array}{r} 8 \\ 5\ ^{13} \\ 4 \\ \hline \end{array} \qquad \begin{array}{r} 13 \\ 4 \\ \hline 17 \end{array}$$

2. Find all the facts in these additions. Write them. For **a** write $9 + 6$ and $15 + 3$. Then write the answers.

a	b	c	d	e	f	g	h
9	8	7	4	8	9	7	8
6	4	7	9	8	9	8	9
3	5	4	6	5	4	5	4

FACTS WITH TWO-PLACE NUMBERS

1. Say the sums without writing them:

a. 2 + 5	12 + 5	22 + 5	**c.** 9 + 2	19 + 2	29 + 2
b. 6 + 4	16 + 4	26 + 4	**d.** 7 + 5	17 + 5	27 + 5

2. Look at the ones. Think the tens. Say the whole answer:

23	26	27	25	33	38	24	22
5	5	3	7	6	3	5	6

3. Look at the ones. Think the tens. Say the sums:

12 + 3	15 + 5	16 + 6	18 + 3	34 + 5
25 + 6	17 + 4	13 + 9	34 + 8	16 + 3

HOW MANY CHILDREN TODAY?

Rose answers the telephone in the principal's office at noon. While there she likes to add the attendance. How many are in each grade today? Each grade has 4 rooms.

Kindergarten	24, 23, 27, 26
Grade 1	33, 29, 28, 35
Grade 2	30, 28, 27, 29
Grade 3	26, 32, 31, 26
Grade 4	29, 34, 30, 28
Grade 5	26, 28, 29, 27
Grade 6	30, 27, 26, 28

How would you find out how many are in the whole school today?

QUESTIONS FOR THE ANSWER STRIP

(1) 14 and 3	(5) 15 and 6	(9) 12 and 7	(13) 13 and 8	(17) 13 and 9
15 and 3	18 and 3	19 and 3	17 and 4	17 and 3
13 and 4	17 and 7	13 and 5	14 and 6	13 and 6
14 and 5	16 and 4	18 and 4	16 and 5	14 and 7

CHANGING PLACE VALUES

When a person adds, he often carries a ten, a hundred, or thousand, and so on to the next higher place value to the left. When he subtracts, he often changes them back to the next lower place value to the right. See how it works for Judy.

1. Judy counted 26 tickets in Miss Smith's room and 28 tickets in Mrs. Wilson's room. When Judy put them together, she made ten ones into a ten. She carried a ten to the next column to the left. Does she have 54 all together?

$$\begin{array}{r} 26 \\ \underline{28} \\ 54 \end{array}$$

2. Now Judy wants to take Mrs. Wilson's tickets back. She must do something with a ten. She has 5 tens. She changes 1 of the tens back to ones. Judy says she *changes* the ten back to ones. Bob says she *carries* a ten back to ones. Do both of them change 54 to 4 tens and 14 ones?

$$\begin{array}{r} {\scriptstyle 4\ 14} \\ \cancel{5}\cancel{4} \\ \underline{28} \end{array}$$

3. In which two of the subtractions below do you change 1 ten to 10 ones? 1 hundred to 10 tens? 1 thousand to 10 hundreds?

a.	**b.**	**c.**	**d.**	**e.**	**f.**
3746	2379	1357	1458	1386	5339
2638	675	1284	263	379	4523

4. Do each subtraction in No. 3 above.

5. Write a subtraction in which you change both tens and hundreds back, and one in which you change both thousands and hundreds back. See the examples at the right.

$$\begin{array}{r} {\scriptstyle 5\ 15} \\ \cancel{6}\cancel{5}3 \\ \underline{472} \\ 181 \end{array} \qquad \begin{array}{r} {\scriptstyle 4\ 12} \\ \cancel{5}\cancel{2}80 \\ \underline{2640} \\ 2640 \end{array}$$

PRACTICE. Subtraction

1.	**2.**	**3.**	**4.**	**5.**	**6.**
95	75	629	924	946	4378
65	27	387	676	584	1728

PRACTICE IN CHANGING TENS AND HUNDREDS

Subtract. See if you can think the changes without writing them.

	a	b	c	d	e	f	g
1. CHANGING TENS:	84 27	72 19	391 252	252 134	73 26	481 358	592 435
2. CHANGING HUNDREDS:	418 257	526 335	364 181	617 493	429 174	588 296	325 183
3. CHANGING TENS AND HUNDREDS:	761 494	842 673	436 258	528 279	931 285	432 146	831 192
4. ZERO IN ONES' PLACE:	790 479	890 532	450 276	620 433	510 380	690 397	890 364

WHEN THE LEFT DIGIT DISAPPEARS

$$\begin{array}{r} 14 \\ \underline{6} \\ 8 \end{array}$$

1. In the number 14, which is the left digit? When you take 6 from 14, how many remain?

What happened to the 1 ten?

Was it changed to ones?

$$\begin{array}{r} 128 \\ \underline{86} \\ 42 \end{array}$$

2. In this example the one stands for what? If you take 86 from 128, what happens to the 1 hundred?

$$\begin{array}{r} 345 \\ \underline{282} \end{array}$$

3. What happens to the hundreds in this example?

4. Subtract these:

a	b	c	d	e	f	g	h
158	139	247	291	460	683	967	450
72	96	153	274	370	595	868	397

ZEROS IN TENS' AND HUNDREDS' PLACES

1. How many tens are in *A*? in *B*? If *A* has 4 tens, would *B* have 40 tens? If one hundred is 10 tens, four hundred is 40 tens.

$$\begin{array}{lr} A & 40 \\ B & 400 \end{array}$$

2. To take 3 from 40, change a ten to ones. To take 3 from 400, also change a ten to ones.

Does one ten from 40 tens leave 39 tens?

$$\begin{array}{r} \overset{3}{\cancel{4}}\,{}^{1}0 \\ \underline{3} \end{array} \qquad \begin{array}{r} \overset{3}{\cancel{4}}\overset{9}{\cancel{0}}\,{}^{1}0 \\ \underline{3} \end{array}$$

3. To take 183 from 400, change a ten back to ones. Take 3 from 10. Then take 8 from 9 and 1 from 3.

Does taking 267 from 502 work the same way?

$$\begin{array}{r} \overset{3}{\cancel{4}}\overset{9}{\cancel{0}}\,{}^{1}0 \\ \underline{183} \\ 217 \end{array} \qquad \begin{array}{r} \overset{4}{\cancel{5}}\overset{9}{\cancel{0}}\,{}^{1}2 \\ \underline{267} \\ 235 \end{array}$$

4. How many tens are there in 4000? How many hundreds are there in 4000?

$$4000 \qquad 4000$$

5. Finish these and explain what has been done. In which one did you change a ten to ones? In which did you change a hundred to tens?

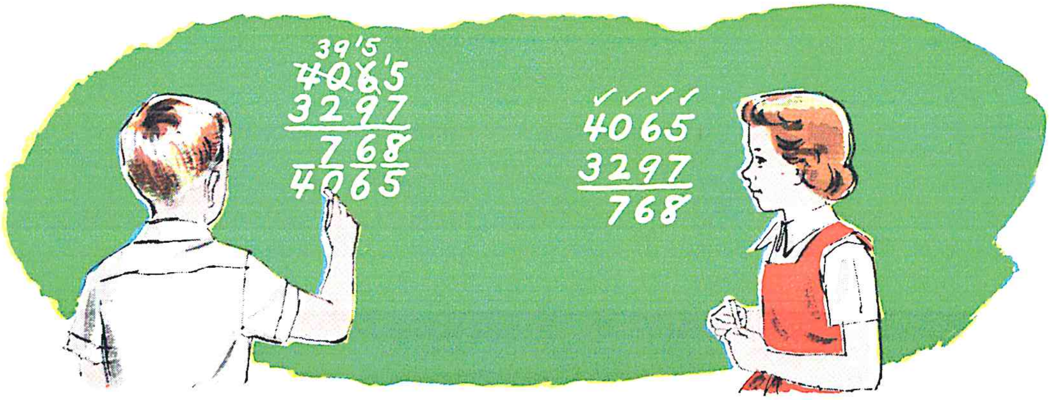
$$\begin{array}{r} \overset{3}{\cancel{4}}\overset{9}{\cancel{0}}\overset{9}{\cancel{0}}\,{}^{1}0 \\ \underline{264} \end{array} \qquad \begin{array}{r} \overset{3}{\cancel{4}}\overset{9}{\cancel{0}}\,{}^{1}0\,0 \\ \underline{630} \\ 0 \end{array}$$

6. The first step in each of these subtractions has been done. What do you do next?

$$\begin{array}{r} 30\overset{5}{\cancel{6}}\,{}^{1}0 \\ \underline{1385} \\ 5 \end{array} \qquad \begin{array}{r} 4\overset{0}{\cancel{1}}\,{}^{1}2 \\ \underline{238} \\ 4 \end{array}$$

PRACTICE. Subtraction

	a	b	c	d	e	f	g
1.	60	500	405	302	1204	806	608
	28	350	79	184	827	608	480
2.	3000	8000	5002	4006	3050	4032	313
	1863	6420	3546	2853	1764	2686	146
3.	400	605	4000	8000	5040	516	6062
	384	528	3172	7260	4386	448	5094



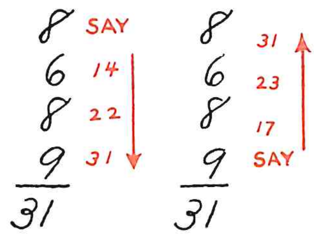
CHECK TO BE SURE

Larry starts with the subtrahend and adds it downward with the difference. He says, "7 and 8 are 15. Carry 1 to 9, and 6 are 16. Carry 1 to 2, and 7 are 10. Carry 1 to 3 is 4. My sum and the minuend are the same. So the answer checks."

Sally says she saves time. She starts with the difference and adds it upward with the subtrahend to get the minuend. She says, "8 and 7 are 15, check. One and 6 and 9 are 16, check. One and 7 and 2 are 10, check. One and 3 are 4, check."

Try both ways to see which is better for you to use.

• In addition you add downward and check upward. If you check in the same direction as you add, you use the same unseen numbers. You might make the same mistake again. Checking in the other direction gives different unseen numbers.



Answer and check:

1. 6475	**2.** 4704	**3.** 3048	**4.** 77	**5.** 69
−5643	−4648	−1882	56	97
			79	58

HELPING IN A STORE

Don helps his father in their store. He makes change by counting coins and then checks by subtracting.

1. A bicycle tire sells for $3.45. What is the change from $5.00? Don says, "$3.45 and *a nickel* is three-fifty, and *a half* makes four, and *a dollar* makes five." Now he checks. Can you see the nickel, the half, and the dollar? →

$$\begin{array}{r} \$5.00 \\ 3.45 \\ \hline \$1.55 \end{array}$$

2. List the coins and bills for change for each example below. Then subtract to find the change. Check.

a	b	c	d	e	f	g
$5.00	$5.00	$4.00	$3.00	$10.00	$10.00	$20.00
1.79	2.98	3.29	2.35	6.78	9.12	16.75

3. Dot buys a horn for $1.59. How much money will she have left from a dollar bill, a half dollar, and a quarter?

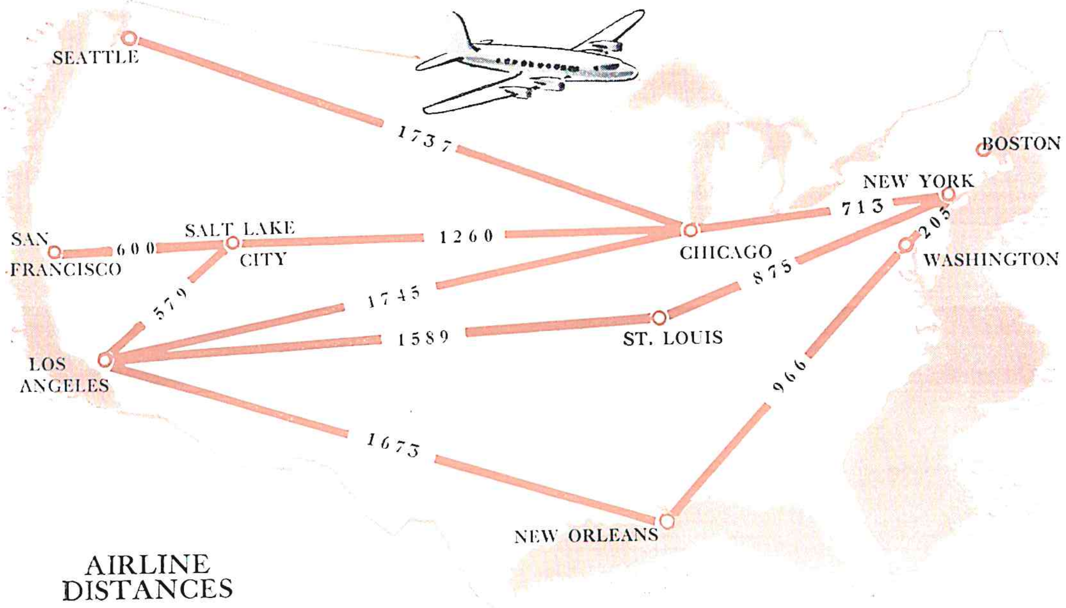
4. Carol buys a plastic seat cover and a handle grip for $1.27. What is the change from $2.00?

5. A super bicycle tire costs $5.25. How much cheaper is a regular tire at $3.45?

6. Bill has $2.50. How much more does he need to buy a new bicycle seat at $3.35?

QUESTIONS FOR THE ANSWER STRIP

(1)	(6)	(11)	(16)	(21)	(26)	(31)
11 − 5	11 − 8	12 − 8	13 − 5	17 − 8	16 − 7	14 − 9
12 − 9	10 − 4	11 − 9	14 − 8	13 − 7	13 − 9	13 − 8
11 − 7	9 − 7	16 − 8	12 − 7	11 − 3	15 − 6	15 − 7
12 − 4	12 − 3	9 − 6	14 − 5	17 − 9	13 − 4	14 − 6
18 − 9	11 − 4	12 − 5	15 − 9	13 − 6	15 − 8	16 − 9



AIRLINE DISTANCES

In the early days of our country it took many days to go from New York to Boston or to Washington. Now it takes only an hour by airplane, or 3 or 4 hours by train.

1. How far is it from New York to San Francisco by this map?

2. How much shorter is it to go straight from Chicago to Los Angeles than to go by Salt Lake City?

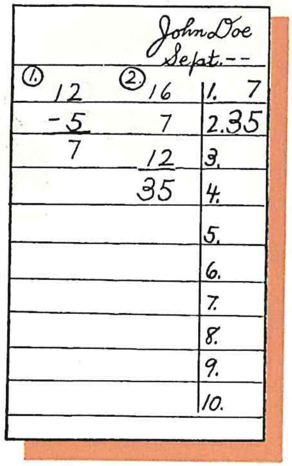
3. Which is closer to New York, San Francisco or Los Angeles?

4. Which route is shortest from New York to Los Angeles? Can you tell by estimating from the numbers? Now find the difference in the distances.

5. How far would a trip be from Los Angeles to New Orleans, Washington, New York, Chicago and back to Los Angeles?

6. Is New York closer to Seattle or to Los Angeles by way of Chicago? Can you tell without adding? What is the difference?

PROBLEM-SOLVING TEST



Put your name on an *answer sheet.* Draw a vertical (up-and-down) line $1\frac{1}{2}$ inches from the right-hand edge. Put the numbers of the problems along the right side of the line. Do your work in the space to the left of the line. Put the answers to the problems at the right of your numbers.

1. There are 12 girls in the room. If 5 of them leave, how many will be left in the room?

2. Joe has 16 marble shooters, and Tom has 7. Each boy plans to buy a box of 12. How many will both of them have then?

3. How many cars will be needed for a school trip? There are 24 children. Six will ride in each car.

4. How many girls are on both school buses? On the first bus there are 18 boys and 14 girls. On the next one there are 16 boys and 15 girls.

5. Dick has $1.75. Art has $2.35. Chuck has $1.95. How much more money does Chuck need to have as much as Art?

6. How much did all of the stamps cost Janet? She bought six-cent stamps for 36¢, three-cent stamps for 27¢, and two-cent stamps for 18¢.

7. A piece of tagboard is 22 inches wide. Joyce needs to cut off a strip one foot wide. How many inches wide will the other strip be?

8. A bicycle light run by the wheel costs $6.49. Another kind costs $10.48. How much cheaper is one of them?

9. Susan started home at 10:30. If the trip takes 3 hr., when will Susan get home?

GAME LIST	
10 Puzzles	$1.95
Ringtoss	1.77
Metal Working	2.98
Our Presidents	1.75
Carom Board	8.41
20 Magic Tricks	2.29
Farm Fun	2.24
Coast to Coast	3.19
Cutout Puzzles	.79
Football Game	1.89
Checkers	.98
Word Lotto	.87

MANY PROBLEMS—RAINY DAY GAMES

Miss Brown's room has $10 to spend for games to play on rainy days. The games committee has made a list of games that pupils want. Each member is making his list.

1. What is the total cost of each member's list? Write each one's prices in a column with his name at the top.

JIM'S LIST: Farm Fun, Football Game, 2 sets each of Ringtoss and Checkers

BARBARA'S: Our Presidents, Coast to Coast, 2 Cutout Puzzles, Metal Working

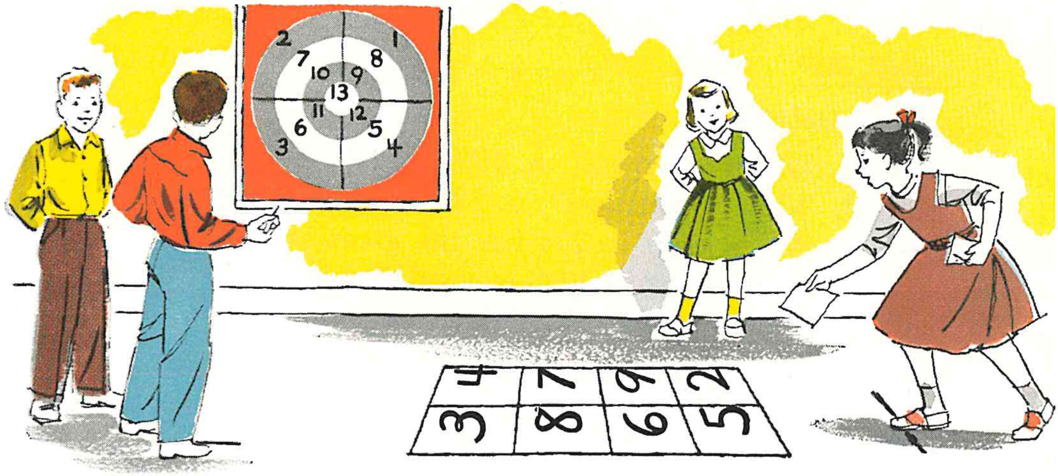
DAVID'S: Carom Board, 10 Puzzles

RUTH'S: Ringtoss, Coast to Coast, 2 sets of Word Lotto, Farm Fun

GEORGE'S: Football Game, 10 Puzzles, Checkers, 20 Magic Tricks, Coast to Coast

2. Make a list of games you'd like to have. Find the total cost of the games.

Look ahead to pages 29, 30, and 33. Plan to have the things you need in class.



THROW WITH SKILL—
READ WITH SKILL

1. Mike has hit an 8 and a 6. He needs 21 all together to tie Fred. How many more must Mike score to tie?

2. Fred's total score is now 47. How much will a hit of 13 and two misses give him?

3. The boys throw darts three times each turn. On his first turn, Fred hit a 7 and missed twice. The next time he missed once and hit twice with scores of 4 and 7. What was his total score then?

4. Betty and Kay throw two beanbags each turn. They were tied. Then Betty scored 12 and Kay scored 7. Kay needs how many to catch up with Betty?

5. In her three turns, Betty has hit every square once except the 6 and 7. What is her score?

6. Add down and check up. Use folded paper.

a	b	c	d	e	f	g	h
49	69	43	45	78	69	58	79
95	37	35	79	47	58	66	88
86	58	89	68	96	89	41	77
72	57	54	66	84	3	37	68

UNIT TEST

Set 1. Meaning

1. Which is largest? **a.** 199 **b.** 203 **c.** 99 **d.** 78
2. Which is smallest? **a.** 230 **b.** 111 **c.** 98 **d.** 86
3. Which digit in 274 has the greatest value?
4. Which digit in 4938 is worth least?
5. Which number is six thousand, forty?
   a. 604 **b.** 640 **c.** 6400 **d.** 6040

Set 2. Addition

1. 56 + 344 + 85 + 503
2. 404 + 68 + 97 + 962
3. 96 + 78 + 72 + 25 + 28
4. 9538 + 4987 + 7379

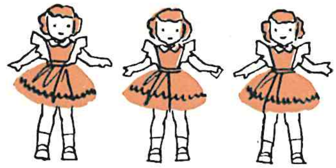
Set 3. Subtraction

Can you remember the changed numbers?

	a	b	c	d	e	f	g
1.	94 76	73 68	867 723	985 867	927 783	679 624	824 698
2.	\$3.29 2.76	\$4.25 3.48	\$1.49 .27	\$1.75 .26	\$3.45 .92	\$1.29 .35	\$1.75 .89
3.	345 324	242 212	564 530	350 320	840 608	432 406	431 428
4.	105 81	126 96	721 660	925 885	500 408	640 585	920 756
5.	540 480	503 450	202 177	406 336	110 82	340 306	410 354

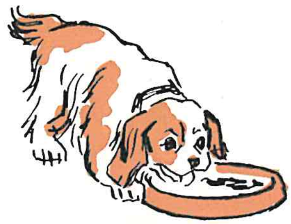
THE ANSWER DEPENDS ON WHAT?

1. George walks 2 miles each hour. How far does he go? The answer depends on what?



2. How much does Martha pay for 3 dolls that are just alike? The answer depends on what?

3. How many weiners will Joe and his 3 friends need to buy for their hike Saturday? On what does the answer depend?



4. How many cans of dog food will Spot eat in a month? On what does the answer depend?

5. How much heavier than Jack is Tom? Tom weighs 69 pounds. He gained 7 pounds last year. On what does the answer depend?

PRACTICE FOR THE ANSWER STRIP

(1) 3 + 5	(6) 7 + 5	(11) 9 + 3	(16) 5 + 7	(21) 7 + 9
7 + 4	9 + 4	7 + 8	8 + 9	6 + 7
9 + 6	6 + 8	5 + 9	7 + 6	9 + 8
4 + 8	3 + 9	8 + 7	9 + 7	8 + 6
6 + 9	8 + 5	9 + 5	5 + 8	4 + 9

(1) 8 − 3	(6) 12 − 7	(11) 12 − 9	(16) 12 − 5	(21) 16 − 7
11 − 7	13 − 9	15 − 7	17 − 8	13 − 6
15 − 9	14 − 6	14 − 5	13 − 7	17 − 9
12 − 4	12 − 3	15 − 8	16 − 9	14 − 8
15 − 6	13 − 8	14 − 9	13 − 5	13 − 4

(1) 14 + 9	(6) 25 + 8	(11) 29 + 5	(16) 28 + 5	(21) 16 + 9
18 + 6	19 + 7	18 + 7	13 + 6	34 + 8
19 + 8	17 + 6	25 + 9	26 + 8	29 + 6
26 + 7	28 + 9	27 + 8	39 + 4	17 + 4
17 + 9	17 + 2	39 + 3	27 + 5	19 + 9

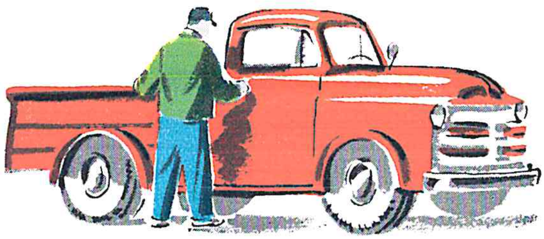
REVIEW OF THE MEASURES

STANDARD MEASURES

1. What does "long ago" mean? "long, long ago"?

2. "I haven't seen him for a long, long time." How long is a "long, long time"? Is it as long as "long, long ago"?

3. How far is "a stone's throw"? Is it a long way or a short distance?



4. When is a thing "very heavy"? Is a very heavy pair of shoes as heavy as a light truck?

5. Is a long nail as long as a short walk?

When people want you to understand better, they compare. Have you heard people say, "as tall as a house," "as cold as ice," "as far as you can see," "as light as a feather," "as fast as a deer," "as quick as a flash"?

6. Which gives you a clearer idea?

a. I live *several* miles from here.

b. I live *5* miles from here?

Could *several miles* mean different things to different people?

• **Standard measures** are measures that nearly everyone has agreed upon. We can depend upon them.

LINEAR MEASURE MEANS DISTANCE

1. Write your estimate of the width of your classroom.

2. Choose 3 children to measure the width of the classroom with their own feet. How many "feet" is it? Do all 3 get the same number of feet? Do all use the same measure for one "foot"?

3. Now choose 3 children to measure the distance with a foot rule and with a yardstick. What is the distance in feet? in yards?

4. Do people agree better on measures when they use the same standard measure?

5. Estimate the distances below and then have someone measure them. Write your estimates.

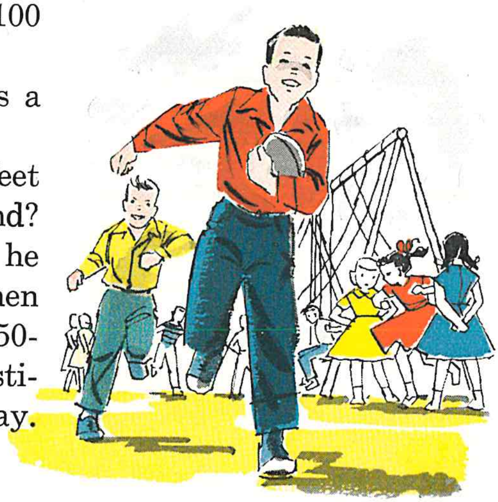
a. Height of the door
b. Height of the teacher's desk
c. Length of the room
d. Length of this page
e. Length and width of a sheet of writing paper
f. This line: ________________________________

6. Take turns trying to draw a line a yard long on the chalkboard. Draw first, then measure.

7. Name a distance that is 100 yards long.

8. Name something that is a mile away.

9. Can you estimate 100 feet and 100 yards on the playground? Each person can walk until he thinks he has gone 100 feet. Then the judges can measure with a 50-ft. or 100-ft. tape. Then try estimating 100 yards in the same way.



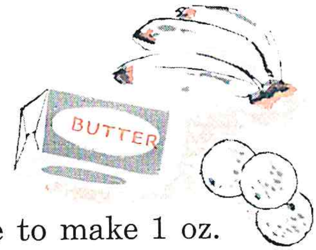
WEIGHING THINGS

1. Think of the size of a pound of ground meat. You can get 6 big hamburgers or 10 small ones from a pound.

2. This is a candy sign. How much does the candy cost a pound? There are 16 ounces in a pound.

39¢
8 oz.

> 16 ounces (oz.) = 1 pound (lb.) 2000 lb. = 1 ton (T.)

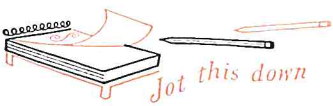


3. Practice estimating weights.

a. Use a pound box which has held butter or margarine. Weigh and wrap up pound bars and quarter-pound bars of modeling clay to use in the box.

b. Put enough paper in an envelope to make 1 oz.

c. Sack up 1-, 2-, 5-, and 10-lb. bags of corn meal, or beans, or corn, or something else you may get easily.



On page 34 you will be asked to tell what measures are used to sell goods. Watch your mother buy things at the store.

PRACTICE

ADD AND CHECK:

(1)	(2)	(3)	(4)
426	507	623	722
674	374	256	376
359	95	20	44
833	85	102	68

SUBTRACT AND CHECK:

(5)	(6)	(7)
458	163	134
368	92	80

(8)	(9)	(10)
504	105	214
429	58	148

TIME

1. Denny is looking for a television program. How long will it be before the Western film starts?

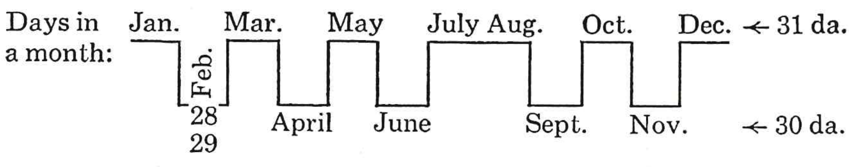
- **a.** Do you think the time is A.M. or P.M.?
- **b.** How long is the film program?
- **c.** What could he see between now and the film?
- **d.** What can he see right now?
- **e.** How long is the first news program?
- **f.** The program is for what day of the week?

2. Answer these questions about a calendar:

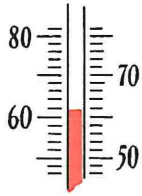
- **a.** On what day of the week will Halloween come?
- **b.** How many days will there be in November?
- **c.** Write the abbreviations of the months.

3. Do you remember these time values?

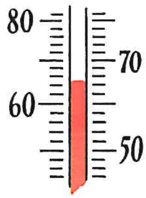
60 seconds = 1 minute	12 mo. = 1 year
60 min. = 1 hour	52 wk. = 1 year
24 hr. = 1 day	365 da. (366) = 1 year
7 da. = 1 week	Leap year has 366 da.



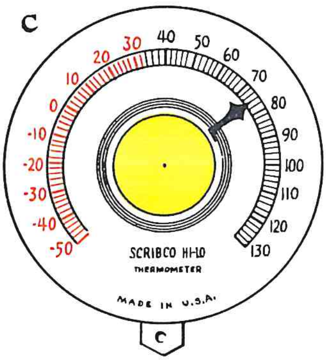
A



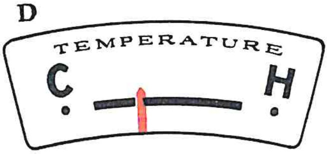
B



C



D



TEMPERATURE

1. What is the temperature in your room?

2. Do you think it is now colder or warmer outdoors? Has the heat been turned on today in your room?

3. Read the temperature on each thermometer at the left.

4. What temperature is called "freezing"? How far above freezing is the temperature on thermometer *C*?

5. Does *D* show that the water in the car is about to boil?

6. What is the temperature of a very warm day where you live? a very cold day?

7. What does a fever mean?

THINGS TO DO

a. Some day write the temperature for every hour you are awake.

b. Bring weather reports to school now and through the winter and spring.

PRACTICE

Add and check:

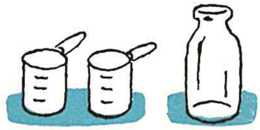
(1)	(2)	(3)
\$8.90	\$6.48	\$0.55
2.50	.99	6.79
1.90	4.25	4.88
6.70	.79	2.97

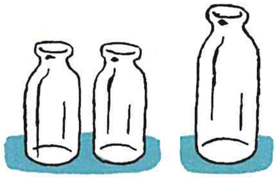
Subtract and check:

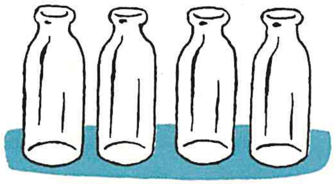
(4)	(5)	(6)
\$2.50	\$5.00	\$3.00
2.23	.67	.60

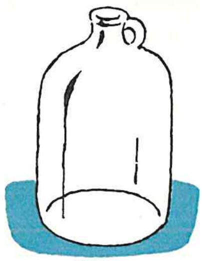
(7)	(8)	(9)
\$6.00	\$10.00	\$10.50
5.49	2.58	4.32

LIQUID AND DRY MEASURES









1. Name several foods that come as liquids. Which do we buy in pints and quarts?

2. Do some liquid foods come in bottles and cans that are not pints and quarts?

3. Is a measuring cup nearer the size of a drinking glass or a teacup?

4. We call $\frac{1}{4}$ of a dollar a *quarter*, but we call $\frac{1}{4}$ of a gallon a _?_. When might we get mixed up if we used the same word for both?

5. How many measuring cups does a quart hold?

6. How many glasses of milk the size of a measuring cup can be poured from a gallon of milk? Try it, but use water instead of milk.

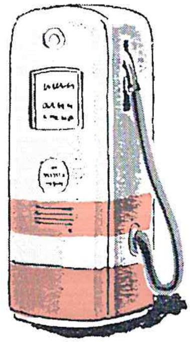
7. In what sizes of measures might a person buy 9 pints of milk? There are at least six combinations without using half pints.

8. Are dry foods, such as cereals, beans, and rice, sold by pints and quarts? How are they sold?

9. Compare the amounts printed on the empty cereal boxes which have been brought to class.

A pint will fill 4 punch cups. How many will a gallon fill?

UNITS FOR SELLING



Things that are sold are weighed, counted, bottled, or packaged. Sometimes they are both weighed and packaged, or counted and bunched. You buy things at so much money for a pound, dozen, pair, quart, bushel, ton, gallon, pint, ounce, yard, bunch, gross, or ream. These are **units for selling.**

Write these numbers. After each write the unit which is used for selling the goods in your town.

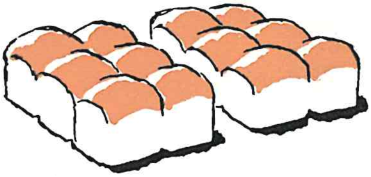
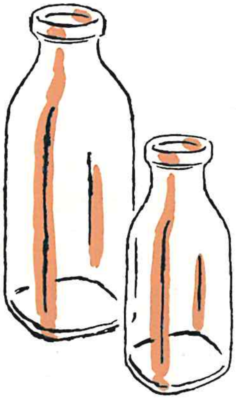
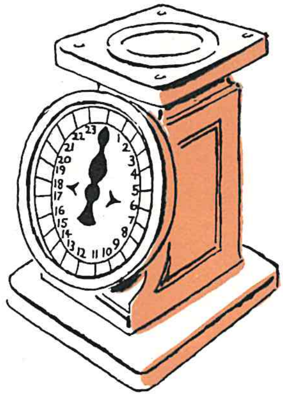
1. gasoline	5. chickens	9. paper	13. buns	17. gloves
2. potatoes	6. grapes	10. toys	14. books	18. trucks
3. butter	7. dresses	11. shoes	15. socks	19. steaks
4. celery	8. ribbon	12. nuts	16. gum	20. tickets

There may be two answers for each of these:

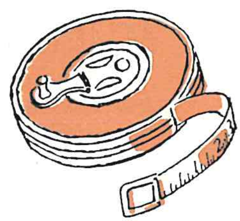
21. oranges	23. lettuce	25. candy	27. bicycle	28. ice cream
22. melons	24. apples	26. cereal	grips	29. chalk

List the cents, nickels, dimes, quarters, and half dollars you should get back if you give a dollar bill to buy:

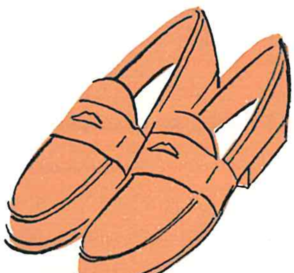
30. a ticket for 55¢	38. grapes for 48¢
31. celery for 23¢	39. socks for 70¢
32. paper for 15¢	40. apples for 38¢
33. ice cream for 64¢	41. ribbon for 92¢
34. shoelaces for 5¢	42. butter for 79¢
35. a book for 60¢	43. oranges for 83¢
36. candy for 10¢	44. cereal for 34¢
37. a melon for 77¢	45. lettuce for 27¢

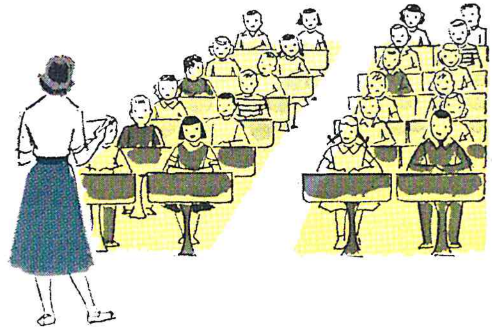




CHANGING UNITS OF MEASURE



1. A quarter pound is how many ounces?
2. A gallon is how many quarts?
3. A yard is how many inches?
4. A dollar is how many nickels?
5. A quart is how many measuring cups?
6. A half dozen doughnuts is how many?
7. A gallon is how many pints?
8. A half dollar and a quarter are how many nickels?
9. A pound and a half are how many ounces?
10. How many inches are $1\frac{1}{2}$ ft.?
11. How many quarts are $1\frac{1}{2}$ gal.?
12. How many feet are there in 3 yd.?
13. How many quarters are there in $5?
14. How many ounces is $\frac{1}{2}$ lb.?
15. Change 42 in. to yards and inches.
16. Change 14 qt. to gallons.
17. Change 50 dimes to dollars.
18. Change 20 oz. to pounds.
19. Change 18 buns to dozens of buns.
20. Two 500-sheet reams are how many sheets of paper? Is a ream always the same number of sheets? Use your dictionary to find out.



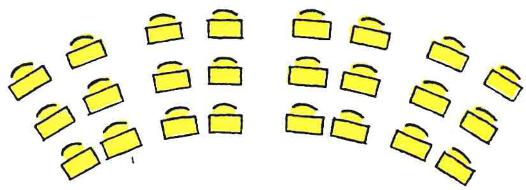


UNIT 3

MULTIPLICATION AND DIVISION

MULTIPLICATION AND DIVISION

Miss Lane looked at the children in her room. There were four rows of six each. "This is a small class," she said, "but some of you seem far away from me."



1. Look at the new seating at the right. What groups do you see?

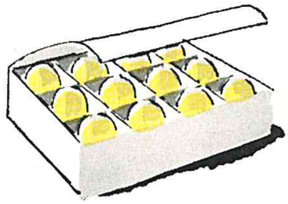
Do you see 3 eights? 2 twelves? 4 sixes?

2. "I like the new way better," said Miss Lane. "We can work in groups of six. We can even work in pairs." How many pairs are there?

Multiplication and *division* helped Miss Lane think about 24. She thought of 4 sixes, 6 fours, 3 eights, 8 threes, 2 twelves, 12 twos.

- Multiplication and division are ways of looking at groups and thinking about them.

THINKING ABOUT EQUAL GROUPS



1. 3 fours are _?_.
$3 \times 4 =$ _?_

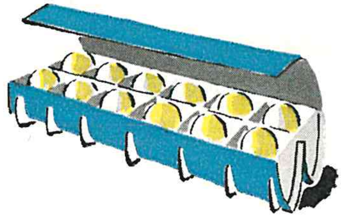
$$\begin{array}{r} 4 \\ \underline{\times 3} \end{array}$$

2. 4 threes are _?_.
$4 \times 3 =$ _?_

$$\begin{array}{r} 3 \\ \underline{\times 4} \end{array}$$

3. How many fours are there in 12?
$12 \div 4 =$ _?_ $\quad 4\overline{)12}$

4. How many threes are there in 12?
$12 \div 3 =$ _?_ $\quad 3\overline{)12}$



5. Write the multiplications and divisions shown by this box of eggs. →

6. Can you multiply to answer these problems?

a. How many chairs are 3 rows with 5 in each row?

b. What will 5 boxes weigh? Each weighs 2 lb.

• *Multiplication* is a way to find the total of equal groups or numbers.

7. Can you divide to answer these problems?

a. Make 6 cookies into equal shares for 2 boys. How many will each boy get?

b. Separate a group of 16 children into 2 equal teams for games. How many will be on each team?

• *Division* is sometimes *separating* into equal groups.

8. Can you divide to solve these problems?

a. How many 3-inch badges can be made from 18 inches of ribbon?

b. How many 5-cent candy bars can you buy with 25¢?

• *Division* is sometimes *measuring* by a number.

MORE ABOUT MULTIPLYING

1. Jim takes 1 plane. Then he takes another 1 and another 1. How many ones does he take? 3 ones are _?_.

2. What is the answer when you multiply 1 by a number?

$8 \times 1 = \underline{\ ?\ }$ $5 \times 1 = \underline{\ ?\ }$ $9 \times 1 = \underline{\ ?\ }$

3. $8 \times 1 = 8$, so $1 \times 8 = \underline{\ ?\ }$. Whenever you multiply a number by 1, the answer is what? Why?

$1 \times 6 = \underline{\ ?\ }$ $1 \times 4 = \underline{\ ?\ }$

4. Zero is a number. It means "not any." No matter how many times you take "not any" (zero), will you still have zero?

N means any number. Is any number times zero always zero? $4 \times 0 = \underline{\ ?\ }$ $7 \times 0 = \underline{\ ?\ }$ $N \times 0 = \underline{\ ?\ }$

5. Copy and multiply. Write the other fact of each pair. See *A* and *B*.

A. $\begin{array}{r}2\\ \underline{3}\\ 6\end{array}$ $\begin{array}{r}3\\ \underline{2}\\ 6\end{array}$ *B.* $\begin{array}{r}5\\ \underline{4}\\ 20\end{array}$ $\begin{array}{r}4\\ \underline{5}\\ 20\end{array}$

	a.	b.	c.	d.	e.	f.
	2	3	2	4	5	2
	4	6	5	3	6	7

	g.	h.	i.	j.	k.	l.
	5	2	4	2	3	5
	3	6	6	9	7	8

	m.	n.	o.	p.	q.	r.
	3	2	5	3	5	4
	9	8	7	8	9	7

6. $2 \times 4 = 8$, so 2×4 tens $= \underline{\ ?\ }$ tens.
$2 \times 3 = 6$, so 2×3 hundreds $= \underline{\ ?\ }$ hundreds.

$\begin{array}{r}40\\ \underline{2}\end{array}$ $\begin{array}{r}300\\ \underline{2}\end{array}$

Do you multiply tens and hundreds like ones?

7. Tell how this mutliplication is done. →

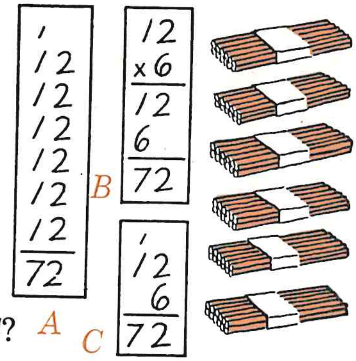
$\begin{array}{r}132\\ \underline{3}\\ 396\end{array}$

CARRYING IN MULTIPLICATION

1. "Bring us 6 dozen pencils from the storeroom, Fred," said Miss Lane. How many pencils are 6 dozen?

Whether you add or multiply, 6 twos are 12. You write the 2 ones and carry 1 ten. Six times the 1 ten in a dozen is 6 tens. 6 tens and the 1 ten that was carried are 7 tens.

Which way is quickest, *A*, or *B*, or *C*?



● To carry means to take tens of any column to the next column at its left.

2. Carrying tens. Multiply these examples:

15	16	18	34	35	23	32	22
3	2	3	4	5	6	7	8

3. Carrying hundreds. Multiply these:

252	241	131	142	483	263	321
3	4	5	3	2	3	6

4. Carrying both tens and hundreds. Multiply:

243	132	246	323	768	223	132
4	6	3	8	2	7	9

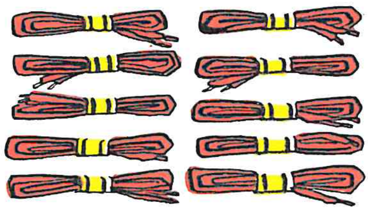
● Zeros are multiplied like other digits. Three fours are 12. Carry the ten. Three zeros are 0. Zero tens and 1 ten are 1 ten. Three twos are 6.

$$\begin{array}{r} 204 \\ 3 \\ \hline 612 \end{array}$$

5. Carrying to zero. Multiply:

306	207	409	203	302	208	707
2	3	2	6	8	3	2

TWO-PLACE MULTIPLIERS



1. How many shoelaces are 10 pairs? 10 twos are __?__.

2. How do you multiply any number by 10? Study the multiplications:

a. Compare 2 and 20.
b. Compare 20 and 200.
c. Compare 200 and 2000.

a	b	c
2	20	200
×10	×10	×10
20	200	2000

3. 10 fives = __?__ 10 twelves = __?__

4. "A box of chalk has 12 dozen pieces," said Miss Lane. "That's called a **gross.**" How many are in a gross?

a. Do 12 dozen equal 10 dozen added to 2 dozen?
How many are 2 twelves? $2 \times 12 = 24$
How many are 10 twelves? $10 \times 12 = 120$
Ten twelves and 2 twelves are how many? → 144

$$\begin{array}{r} 12 \\ \times 12 \\ \hline 24 \\ 12 \\ \hline 144 \end{array}$$

b. Here is another way to find 12×12.
← Two twelves are 24.
← Ten twelves are 120. Why is the zero not written? Is it needed if you keep the columns straight?

5. Do you remember the names below?

21 ← multiplicand
23 ← multiplier
63 ← ones' product } **partial**
42 ← tens' product } **products**
483 product

The ones' and tens' products are called *partial products* because they are *parts* of the whole product.

6. Copy and multiply:

a.	b.	c.	d.	e.	f.	g.	h.
32	43	24	13	14	23	22	12
21	12	22	32	21	12	31	24

▶ CARRYING WITH TWO-PLACE MULTIPLIERS

1. Jane lives at the edge of town. Her father works in town. He also raises chickens and sells eggs. Last week he sold 36 dozen eggs. How many are 36 dozen?

You know how to multiply 12 by 6 ones. You know how to multiply 12 by 3 tens. Be sure to put the **partial products** in their correct places. Then add them.

$$\begin{array}{r} 12 \\ \times 36 \\ \hline 72 \\ 36 \\ \hline 432 \end{array}$$

2. Suppose you want to know how many pieces of chalk there are in 36 boxes. You wonder if it will last all year. When Jack multiplies by 3, where will he write the carry numbers? May he get the numbers all mixed up? Will Dave get them mixed? He carries them in his head.

JACK'S WAY

$$\begin{array}{r} {\scriptstyle 22} \\ 144 \\ 36 \\ \hline 864 \\ 2 \end{array}$$

DAVE'S WAY

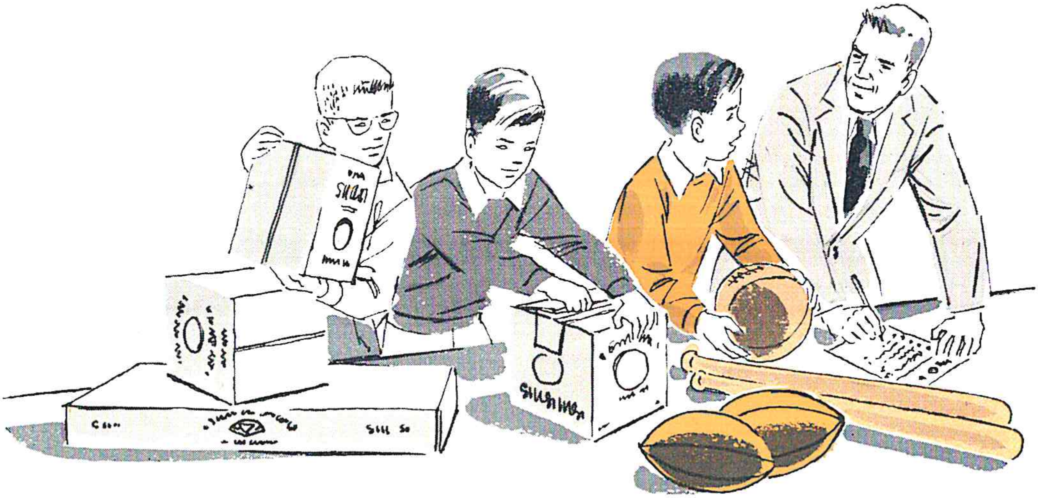
$$\begin{array}{r} 144 \\ 36 \\ \hline 864 \\ 2 \end{array}$$

3. Say the answers:

24 + 1	18 + 2	30 + 3
27 + 2	35 + 2	45 + 3
16 + 2	20 + 2	25 + 4

Copy and multiply:

	a	b	c	d	e	f	g	h
4.	232 28	123 36	254 23	123 19	324 25	132 37	234 44	142 65
5.	368 52	165 34	523 58	132 89	523 76	322 97	587 53	497 32
6.	523 86	144 58	231 79	218 53	152 49	254 74	254 63	597 35



MULTIPLYING MONEY

PLAYGROUND EQUIPMENT

"That must have cost a lot, didn't it, Mr. Clark?" "Quite a bit, Harvey. Suppose you check the bill to see if it is right."

3 kickballs	@	$2.95	$ 8.85
3 bats	@	.89	2.67
4 softballs	@	1.43	5.72
2 ringtoss	@	1.77	3.54
1 table tennis	@	3.98	3.98
Total			$24.76

"It looks right," said Harvey. "Three balls at almost $3 each would be nearly $9. Three bats at less than $1 each would be nearly $3. Four softballs at about $1.50 would be about $6."

"I want it exact, Harvey," said Mr. Clark.

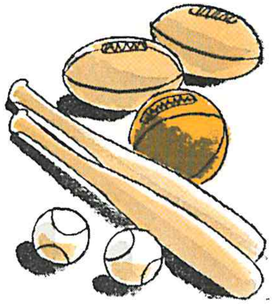
1. Harvey checked this way:

$2.95	$ .89	$1.43	$1.77	$3.98 √
3	3	4	2	
$8.85 √	$2.67 √	$5.72 √	$3.54 √	

Finish Harvey's checking. Is the bill right?

2. How did Harvey find the cost of each item? Was it quicker for him to multiply than to add?

DO YOU MULTIPLY OR ADD?



Do you multiply or add? Which is easier?

1. What is the cost

- **a.** of 3 baseball bats at \$1.21 each?
- **b.** of 2 basketballs at \$5.49 each?
- **c.** of 3 junior footballs at \$1.89 each?
- **d.** of 3 croquet sets at \$10.98 each?
- **e.** of a kickball at \$3.49 and a basketball at \$5.98?
- **f.** of 2 softballs at \$1.29 each and a bat at \$1.21?

ESTIMATING

Four possible answers are given for each problem below. Judge the most reasonable answer without using paper. Write it down and then check by multiplying.

2. Two bats at 85¢ each will cost

a. \$1.70 **b.** \$3.00 **c.** \$4.85 **d.** \$8.50

3. What will 4 softballs cost at \$1.25 each?

a. \$4.25 **b.** \$5.00 **c.** \$6.00 **d.** \$10.00

4. Three kickballs at \$2.95 each will cost

a. \$5.95 **b.** \$8.85 **c.** \$10.85 **d.** \$11.85

Multiply:

	a	b	c	d	e	f
5.	\$2.40	\$2.03	\$1.12	\$2.23	\$3.00	\$2.04
	2	4	8	6	9	5
6.	\$1.22	\$3.33	\$2.10	\$2.20	\$10.00	\$1.20
	7	3	6	9	2	8
7.	\$4.23	\$12.35	\$2.25	\$1.03	\$.23	\$0.45
	5	2	4	6	7	3

MEANING OF DIVISION

1. In division what is the name of the answer? of the number we divide? of the number by which we divide?

$$\begin{array}{rl} 5 & \leftarrow \text{quotient} \\ 2\overline{)10} & \leftarrow \text{dividend} \\ \uparrow & \text{divisor} \end{array}$$

2. In each problem below you divide 12 cookies. But the quotients do not all stand for cookies. Tell what the answer means for each problem.

a. Margaret is dividing 12 cookies equally among 3 girls. What is the quotient? Four what?

b. Dorothy wants to know how many days 12 cookies will last if she eats 2 each day. Six what?

c. Frank wants to know how many boys can have 4 cookies each out of a dozen cookies.

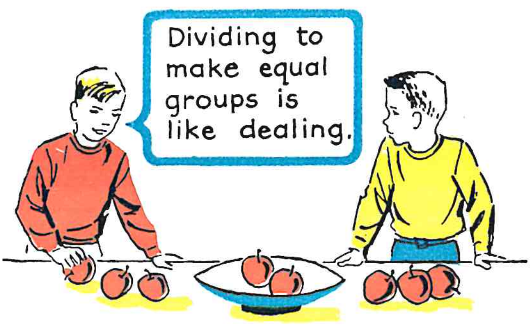
d. Bobby's mother says Bobby's share of 12 cookies is $\frac{1}{3}$ of them. How many are his share?

e. If mother saves $\frac{1}{2}$ of a dozen cookies for tomorrow, how many does she save?

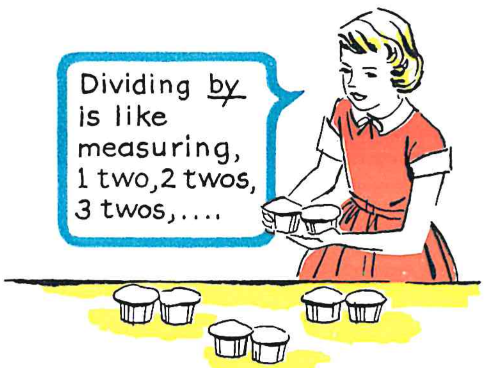
f. How many children can be served 2 cookies each from 12 cookies?

3. Lay out 8 counters on your desk. Do first what Jack is doing. Then do what Jean is doing.

Jack is sharing 8 apples equally with a friend.



Jean is finding how many people 8 cupcakes will serve 2 cakes each.



4. You have a plate of 12 sandwiches. Use counters to stand for them.

a. How many people may have 4 each? *Give each person* 4 *until all are given.*

b. Share 12 sandwiches equally among 4 people. *Lay out one for each fourth,* then another for each fourth, and so on until all are given.

$$\begin{array}{r} 12 \\ \underline{-4}\surd \\ 8 \\ \underline{-4}\surd \\ 4 \\ \underline{-4}\surd \end{array}$$

Did you take 4 each time in **a** and **b**? $4\overline{)12}$

● No matter which way you think division, you can always divide by seeing how many times you can take the divisor away.

5. $4 \div 2 = 2$. Does 4 tens $\div\ 2 =$ 2 tens? $2\overline{)40}$

6. There are 24 boys for 2 teams in kickball. How many will be on each team? →

$$\begin{array}{r} \text{1 ten} \\ 2\overline{)\text{2 tens}} \end{array} \quad \begin{array}{r} \text{2 ones} \\ 2\overline{)\text{4 ones}} \end{array} \quad \Bigg| \quad \begin{array}{r} 12 \\ 2\overline{)24} \end{array}$$

7. The 3 fifth grades will take equal shares of our 126 new books. How many will each grade get?

Are there 3 hundreds in 126? Can each have 100?

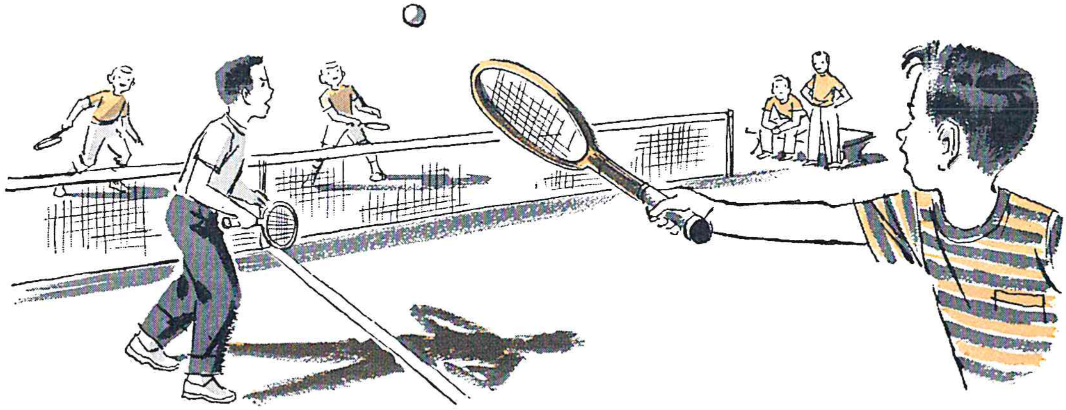
Does $126 =$ 12 tens and 6 ones?

$$\begin{array}{r} \text{4 tens} \\ 3\overline{)\text{12 tens}} \end{array} \quad \begin{array}{r} \text{2 ones} \\ 3\overline{)\text{6 ones}} \end{array} \quad \Bigg| \quad \begin{array}{r} 42 \\ 3\overline{)126} \end{array}$$

● You divide tens and hundreds like ones.

Copy and divide:

	a	b	c	d	e	f
8.	$5\overline{)15}$	$6\overline{)12}$	$3\overline{)21}$	$4\overline{)20}$	$9\overline{)27}$	$5\overline{)45}$
9.	$3\overline{)39}$	$4\overline{)80}$	$2\overline{)166}$	$3\overline{)156}$	$5\overline{)105}$	$2\overline{)1264}$
10.	$7\overline{)147}$	$4\overline{)128}$	$5\overline{)255}$	$4\overline{)160}$	$2\overline{)184}$	$3\overline{)1869}$
11.	$8\overline{)168}$	$2\overline{)120}$	$9\overline{)189}$	$3\overline{)246}$	$7\overline{)210}$	$2\overline{)1484}$



DIVISION WITH REMAINDERS

$$\begin{array}{r} 2 \\ 4\overline{)9} \\ \underline{8} \\ 1 \end{array}$$

1. Nine children want to play tennis. Four can play on a court. How many groups of four are 9?

← Can you take 2 fours from 9?

← Is there 1 left over?

$$\begin{array}{r} 5 \\ 4\overline{)23} \\ \underline{20} \\ 3 \end{array}$$

2. Suppose 23 children want to play tennis. How many groups of 4 are in 23?

Tell how to do the division.

$$\begin{array}{r} 2 \\ 2\overline{)52} \\ \underline{4} \\ 1 \end{array}$$

3. Fifty-two children are going to a Play Day in 2 buses. What will be an equal number in each bus?

← Does 5 tens $\div$ 2 = 2 tens?

$2 \times 2 =$ _?_. $5 - 4 =$ _?_.

The 5 is called a **partial dividend.**

There is more of the dividend to be divided.

$$\begin{array}{r} 26 \\ 2\overline{)52} \\ \underline{4} \\ 12 \\ \underline{12} \end{array}$$

Bring the 2 ones down beside the 1 ten. The next partial dividend is 12.

← Are there 6 twos in 12? Are there any left over?

Copy and divide:

	a	b	c	d	e	f
4.	$4\overline{)172}$	$7\overline{)224}$	$5\overline{)175}$	$8\overline{)176}$	$3\overline{)108}$	$7\overline{)161}$
5.	$6\overline{)192}$	$8\overline{)256}$	$3\overline{)174}$	$9\overline{)207}$	$8\overline{)184}$	$9\overline{)468}$
6.	$4\overline{)216}$	$7\overline{)231}$	$9\overline{)135}$	$6\overline{)258}$	$9\overline{)288}$	$7\overline{)154}$

MORE ABOUT REMAINDERS

1. Steve was dividing his 35 chickens into groups for 2 pens.

$$\begin{array}{r} 17 \\ 2\overline{)35} \\ \underline{2} \\ 15 \\ \underline{14} \\ 1 \end{array}$$

Steve first divided the 3 tens. He had 1 ten and 5 ones (15) left to divide. He divided 14 of these 15 and had 1 left.

2. How could you divide 143 chickens as equally as possible into 4 pens?

$$\begin{array}{r} 35 \\ 4\overline{)143} \\ \underline{12} \\ 23 \\ \underline{20} \\ 3 \end{array}$$

Explain the division at the right.

Some of the divisions below are already done for you. Tell what happens in each. Then do the other divisions.

3. One-digit quotients

a. $\begin{array}{r} 3 \\ 2\overline{)7} \\ \underline{6} \\ 1 \end{array}$ **b.** $\begin{array}{r} 5 \\ 3\overline{)17} \\ \underline{15} \\ 2 \end{array}$ **c.** $3\overline{)8}$ **d.** $4\overline{)21}$ **e.** $2\overline{)13}$

f. $4\overline{)27}$ **g.** $5\overline{)18}$ **h.** $6\overline{)20}$

4. Two-digit quotients

a. $\begin{array}{r} 38 \\ 2\overline{)76} \\ \underline{6} \\ 16 \\ \underline{16} \end{array}$ **b.** $\begin{array}{r} 24 \\ 3\overline{)73} \\ \underline{6} \\ 13 \\ \underline{12} \\ 1 \end{array}$ **c.** $\begin{array}{r} 67 \\ 2\overline{)135} \\ \underline{12} \\ 15 \\ \underline{14} \\ 1 \end{array}$ **d.** $3\overline{)84}$ **e.** $2\overline{)93}$

f. $3\overline{)168}$ **g.** $2\overline{)113}$

h. $3\overline{)82}$ **i.** $3\overline{)151}$

5. Three-digit quotients

a. $\begin{array}{r} 238 \\ 3\overline{)714} \\ \underline{6} \\ 11 \\ \underline{9} \\ 24 \\ \underline{24} \end{array}$ **b.** $\begin{array}{r} 346 \\ 4\overline{)1385} \\ \underline{12} \\ 18 \\ \underline{16} \\ 25 \\ \underline{24} \\ 1 \end{array}$ **c.** $\begin{array}{r} 235 \\ 3\overline{)707} \\ \underline{6} \\ 10 \\ \underline{9} \\ 17 \\ \underline{15} \\ 2 \end{array}$ **d.** $4\overline{)984}$ **e.** $5\overline{)1262}$

f. $4\overline{)504}$ **g.** $3\overline{)1158}$

h. $4\overline{)1815}$ **i.** $3\overline{)805}$

ZEROS IN DIVISION

$$\begin{array}{r} 43 \\ 2\overline{)86} \\ 8 \\ \hline 6 \\ 6 \\ \hline \end{array}$$

1. Tell how this division is done. Does $8 - 8 = 0$? Does $6 - 6 = 0$? Why are the zeros not written as remainders? Tell how to do **a, b,** and **c.**

a. $3\overline{)98}$ **b.** $4\overline{)168}$ **c.** $5\overline{)257}$

$$\begin{array}{r} 307 \\ 2\overline{)614} \\ 6 \\ \hline 14 \\ 14 \\ \hline \end{array}$$

2. Is 6 the first partial dividend? What is the next? Was the **1** brought down? How many twos are there in 1? What was written in the quotient above 1?

What was done next? → $14 \div 2 = ?$

• Zeros are used in the quotient when the partial dividend is smaller than the divisor.

$$\begin{array}{r} 203 \\ 3\overline{)609} \\ 6 \\ \hline 09 \\ 9 \\ \hline \end{array}$$

3. What is the first partial dividend? What is the next? Was the **0** brought down? Tell how to do this division.

4. Tell how to do this division. → Where is the zero? Why?

$$\begin{array}{r} 240 \\ 4\overline{)961} \\ 8 \\ \hline 16 \\ 16 \\ \hline 1 \end{array}$$

• For each time you bring down a number, there must be another quotient digit.

5. Tell how to do each division:

a. $3\overline{)126}$ **b.** $2\overline{)615}$ **c.** $4\overline{)809}$ **d.** $3\overline{)510}$ **e.** $5\overline{)2515}$

Copy and divide:

	a	b	c	d	e
6.	$4\overline{)1204}$	$5\overline{)1752}$	$4\overline{)1623}$	$3\overline{)1207}$	$5\overline{)2650}$
7.	$4\overline{)247}$	$4\overline{)826}$	$3\overline{)608}$	$5\overline{)650}$	$3\overline{)2112}$
8.	$7\overline{)1407}$	$4\overline{)2123}$	$3\overline{)2417}$	$4\overline{)1607}$	$6\overline{)1920}$

EQUAL SHARES—SATURDAY FUN

One Saturday three neighbor girls decided to do everything on equal shares. They had fun. When three people have equal shares of something, what is each share called?

1. First the girls played with dolls. Dot had 11, Ruth had 8, and Joyce had 5 dolls. If each girl played with an equal number, how many dolls could each have? How do you find $\frac{1}{3}$ of 24?

2. Washing the dishes was easy to share equally. There are 3 people in Dot's family, 5 in Joyce's, and 4 in Ruth's. What was probably the equal share of plates to wash at lunch time?

3. Soon they went out to ride the bicycle. "One bicycle! Not even a wheel apiece!" said Dot.

"I know what to do," said Ruth. "We have time to ride about 30 blocks. We'll each ride our share."

What is an equal share of 30 blocks for each of 3 girls?

4. "Let's play with kitty," said Joyce. "How can you divide a cat into 3 shares?" asked Dot.

Joyce had the answer. "We'll play with him an hour. We can share an hour equally." How long would each have the kitty?

5. Find:

a. $\frac{1}{4}$ of 16	**d.** $\frac{1}{7}$ of 21	**g.** $\frac{1}{5}$ of 40	**j.** $\frac{1}{3}$ of 21
b. $\frac{1}{2}$ of 14	**e.** $\frac{1}{3}$ of 18	**h.** $\frac{1}{6}$ of 18	**k.** $\frac{1}{8}$ of 40
c. $\frac{1}{5}$ of 35	**f.** $\frac{1}{8}$ of 24	**i.** $\frac{1}{4}$ of 20	**l.** $\frac{1}{6}$ of 24

DIVIDING MONEY

$$\begin{array}{r} \$1.25 \\ 3\overline{)\$3.75} \\ \underline{3} \\ 7 \\ \underline{6} \\ 15 \\ \underline{15} \end{array}$$

1. A rubber football costs \$3.75. Three boys plan to pay equal shares. Divide \$3.75 by 3. Estimate the answer first. How many dollars and how many quarters would each boy pay?

First you divide the dollars. Then divide the dimes. Then divide the 15 cents that are left.

A.

$$\begin{array}{r} \$\ .75 \\ 2\overline{)\$1.50} \\ \underline{1\ 4} \\ 10 \\ \underline{10} \end{array}$$

2. A ticket that costs Dad \$1.50 is half price for children under 12. What is half of \$1.50? What do you think it will be?

What is $\frac{1}{2}$ of 15 dimes? Read the rest of Example *A*.

B.

$$\begin{array}{r} 75 \\ 2\overline{)150} \\ \underline{14} \\ 10 \\ \underline{10} \end{array}$$

Dividing money numbers is just like dividing other numbers. *A* is like *B*, but in *A* you have to think where to write the point to show cents correctly. Where do you write the point?

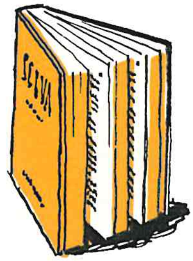
3. Tell what happens in these divisions of money:

a. $2\overline{)\$4.08}$ **b.** $2\overline{)\$5.24}$ **c.** $3\overline{)\$6.15}$ **d.** $4\overline{)\$8.40}$

Copy and divide:

	a	b	c	d	e
4.	$3\overline{)\$9.45}$	$5\overline{)\$25.50}$	$4\overline{)\$16.80}$	$6\overline{)\$13.20}$	$8\overline{)\$18.40}$
5.	$4\overline{)\$3.00}$	$9\overline{)\$18.00}$	$5\overline{)\$1.50}$	$7\overline{)\$1.40}$	$3\overline{)\$2.76}$
6.	$3\overline{)\$9.15}$	$2\overline{)\$0.90}$	$4\overline{)\$1.80}$	$8\overline{)\$16.08}$	$6\overline{)\$12.18}$

When something is two for a quarter, what do you usually pay the grocer for one of them? If something is 3 for a quarter, what do you pay for one?



PROBLEMS

1. Martha knows how many pages are in her library book. She wants to read it in three days. How does she find out how much she must read daily?

2. Sandra knows how much money she has to last three more weeks. How much can she spend each week?

3. Our teacher knows how much writing paper we have on hand. She knows how much we use each week. How will she know when the next order must come?

GROWTH TEST

1. $\begin{array}{r} 8 \\ 8 \\ \underline{5} \end{array}$

2. Subtract $\begin{array}{r} 191 \\ \underline{96} \end{array}$

3. $\begin{array}{r} 79 \\ 32 \\ \underline{69} \end{array}$

4. Multiply $\begin{array}{r} 52 \\ \underline{3} \end{array}$

5. $5\overline{)250}$

6. $\frac{1}{3}$ of 21

7. $\begin{array}{r} 74 \\ \underline{\times 5} \end{array}$

8. Subtract $\begin{array}{r} 305 \\ \underline{240} \end{array}$

9. $\begin{array}{r} 75 \\ 42 \\ 43 \\ \underline{46} \end{array}$

10. Multiply $\begin{array}{r} 426 \\ \underline{4} \end{array}$

11. Subtract $\begin{array}{r} 1023 \\ \underline{486} \end{array}$

12. $\begin{array}{r} 30 \\ \underline{\times 13} \end{array}$

13. $\begin{array}{r} 213 \\ \underline{\times 49} \end{array}$

14. $\begin{array}{r} 35 \\ 133 \\ 650 \\ \underline{496} \end{array}$

15. $6\overline{)246}$

16. $3\overline{)127}$

17. Multiply $\begin{array}{r} 806 \\ \underline{26} \end{array}$

18. $\begin{array}{r} 5000 \\ \underline{-4780} \end{array}$

19. $8\overline{)179}$

20. $5\overline{)152}$

An even number is a number which can be divided by 2 without having a remainder. When any number is multiplied by 2, is the product an even number? What is an odd number?

UNIT 4

AN EXPERIMENT CLINCHING MULTIPLICATION

AN EXPERIMENT

What is an experiment? Is it something you try in order to find out something? Bob says a piece of metal will float in water. Will it? He experimented to find out.

Bob laid a small needle gently on the surface of a bowl of water. Then he used a magnet for his "engine" and drew his floating metal around.

OUR EXPERIMENT

Time: Arithmetic class time for two weeks.

1. *What we want to find out*:
How nearly perfect each of us can become in multiplication in two weeks.

2. *What we do*:

- **a.** Test to see how well we multiply now.
- **b.** Reason out multiplication facts; then practice them.
- **c.** Understand how to carry.
- **d.** Reason out carry facts; then practice them.
- **e.** Test again to see what we have learned.

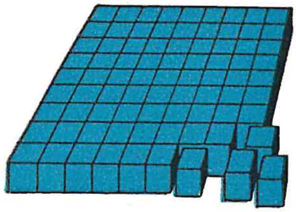
3. *Results*:
At the end of two weeks we shall compare the first test with the second test.

TEACHER'S NOTE: Read instructions for this unit in the Teacher's Guide.

MATERIAL NEEDED AND WHAT TO DO

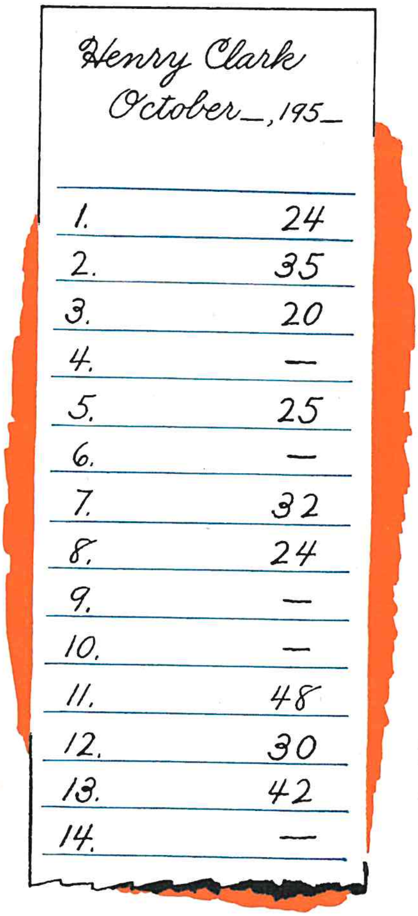
By Your Teacher

1. Tests to be duplicated. See pages 316–319.
2. A watch with a second hand is very helpful.
3. 81 or more one-inch cubes for pupils to use to find products are useful but not necessary.



By You

1. Answer strips like Henry's to be used each day.
2. Folded paper for practice.



WHAT YOU DO

1st day. Take tests Set 1, A, B, and C, pages 316 and 317.

2nd day. Clinch the nines, p. 54.

3rd day. Fours and sixes, p. 56.

4th day. Sevens and eights, p. 58.

5th day. Study and practice, p. 60.

6th day. Carry facts, pp. 62, 63.

7th day. Study and practice, p. 64.

8th day. Division facts, p. 66.

9th day. Practice, p. 67.

10th day. Final tests, Set 1, A, B, and C, pages 318 and 319.

Pupils who do not need much practice may do pages 55, 57, 59, 61, and 65.

▶ CLINCHING THE NINES

See how many things you can find out about the nines which will help you remember them. Study the nines table below to find answers to the questions.

1. As the products get larger, what happens

a. to the ones' digits?

b. to the tens' digits?

2. How many are 2 tens? 2 nines? 3 tens? 3 nines?

Compare the tens' digit of each product with the multiplier.

$1 \times 9 = \mathbf{9}$	1 nine is in the *ones*.
$2 \times 9 = \mathbf{18}$	2 nines are in the *teens*.
$3 \times 9 = \mathbf{27}$	3 nines are in the *twenties*.
$4 \times 9 = \mathbf{36}$	4 nines are in the _?_
$5 \times 9 = \mathbf{45}$	5 nines are in the _?_
$6 \times 9 = \mathbf{54}$	6 nines are in the _?_
$7 \times 9 = \mathbf{63}$	7 nines are in the _?_
$8 \times 9 = \mathbf{72}$	8 nines are in the _?_
$9 \times 9 = \mathbf{81}$	9 nines are in the _?_

3. Do you see another interesting relationship?

An idea: **18** $\rightarrow 1 + 8 =$ _?_

36 $\rightarrow 3 + 6 =$ _?_ **45** $\rightarrow 4 + 5 =$ _?_ **27** $\rightarrow 2 + 7 =$ _?_

63 $\rightarrow 6 + 3 =$ _?_ **72** $\rightarrow 7 + 2 =$ _?_ **54** $\rightarrow 5 + 4 =$ _?_

4. 6 nines are in the *fifties* 5 + _?_ = 9 $6 \times 9 =$ _?_

7 nines are in the *sixties* _?_ + _?_ = 9 $7 \times 9 =$ _?_

8 nines are in the _?_ _?_ + _?_ = 9 $8 \times 9 =$ _?_

QUESTIONS FOR THE ANSWER STRIP

9×9	9×8	9×2	4×9	9×6	9×5	9×4
2×8	3×6	7×9	6×9	2×7	3×8	2×9
3×9	5×9	3×5	3×7	9×3	8×9	9×7

THE SEASONS

Write the answer for each of the following questions on an answer sheet:

1. What season is it "When the frost is on the pumpkin, and the fodder's in the shock"?

2. If fall begins September 22 and ends December 22, how many days long is it?

3. The earth takes one day to make one complete turn. How many hours is that? How many minutes?

4. Part of the year the earth is turned so that the sun seems lower. That part of the year is winter. The same space gets less sunlight, so it is colder. When it is winter where you live, what season is it in most of Brazil? in Europe? in Asia? in Australia? in northern Africa?

5. Look at the temperature shown for one day:

a. In which city did the temperature change most? change least?

b. Winnipeg was how many degrees colder than each other city?

c. Los Angeles was how much warmer than New York?

d. Which cities may have had frost?

City	Degrees	
	High	*Low*
Chicago	58	28
Los Angeles	64	52
New Orleans	72	56
New York	62	42
Winnipeg	48	16

FOURS AND SIXES

Here are the products of fours and sixes:

PRODUCTS OF FOURS					PRODUCTS OF SIXES				
4	8	12	16	20	6	12	18	24	30
24	28	32	36	40	36	42	48	54	60

1. Are the products of fours and sixes odd or even numbers?

2. See how the endings repeat. The fours repeat at 20 higher. The sixes repeat at 30 higher. Write the products of twos and eights. Do their endings repeat?

3. It is easy to remember that 5 fours are 20. Can you add 4 to 20 and get 6 fours? $6 \times 4 = \underline{\ ?\ }$

4. You know that 9 fours are 36. Can you take 4 from 36 and get 8 fours? $8 \times 4 = \underline{\ ?\ }$ Can you think of other ways that will help you remember the fours?

5. It helps to remember that 5 sixes are 30. If 5 sixes are 30, how many are 6 sixes? $6 \times 6 = \underline{\ ?\ }$

6. You learned that 6 nines are in the fifties, 54, so $9 \times 6 = \underline{\ ?\ }$. To know 6×9 helps to know 9×6.

QUESTIONS FOR THE ANSWER STRIP

(1)	(7)	(13)	(19)	(25)	(31)	(37)
5 × 4	9 × 6	5 × 6	4 × 3	6 × 3	6 × 5	5 × 5
3 × 8	7 × 5	9 × 7	9 × 9	4 × 8	8 × 3	9 × 3
6 × 6	3 × 6	4 × 5	6 × 4	8 × 6	9 × 5	8 × 4
5 × 8	4 × 9	6 × 8	7 × 9	9 × 4	7 × 6	5 × 7
7 × 4	6 × 7	3 × 9	9 × 8	8 × 9	6 × 9	4 × 6
3 × 5	4 × 4	8 × 5	5 × 9	3 × 7	4 × 7	7 × 3

Study the facts you had wrong or left out. Perhaps you can work quietly with a partner.

ALTITUDES

1. What is the **altitude** of the place where you live? The altitude of a place is its distance above or below sea level.

2. What are the highest and lowest places shown on the graph at the right? What is the altitude of Mt. Whitney?

The minus sign before 280 means that Death Valley is 280 feet *below* sea level.

3. The table below shows the altitudes of some cities in the United States.

Altitudes in Feet

Chicago	598	Minneapolis	800
Denver	5280	New York	sea level
Houston	54	Omaha	1030
Kansas City	773	Pittsburgh	740
Leadville	10,152	Salt Lake City	4357

4. What is the change in altitude from

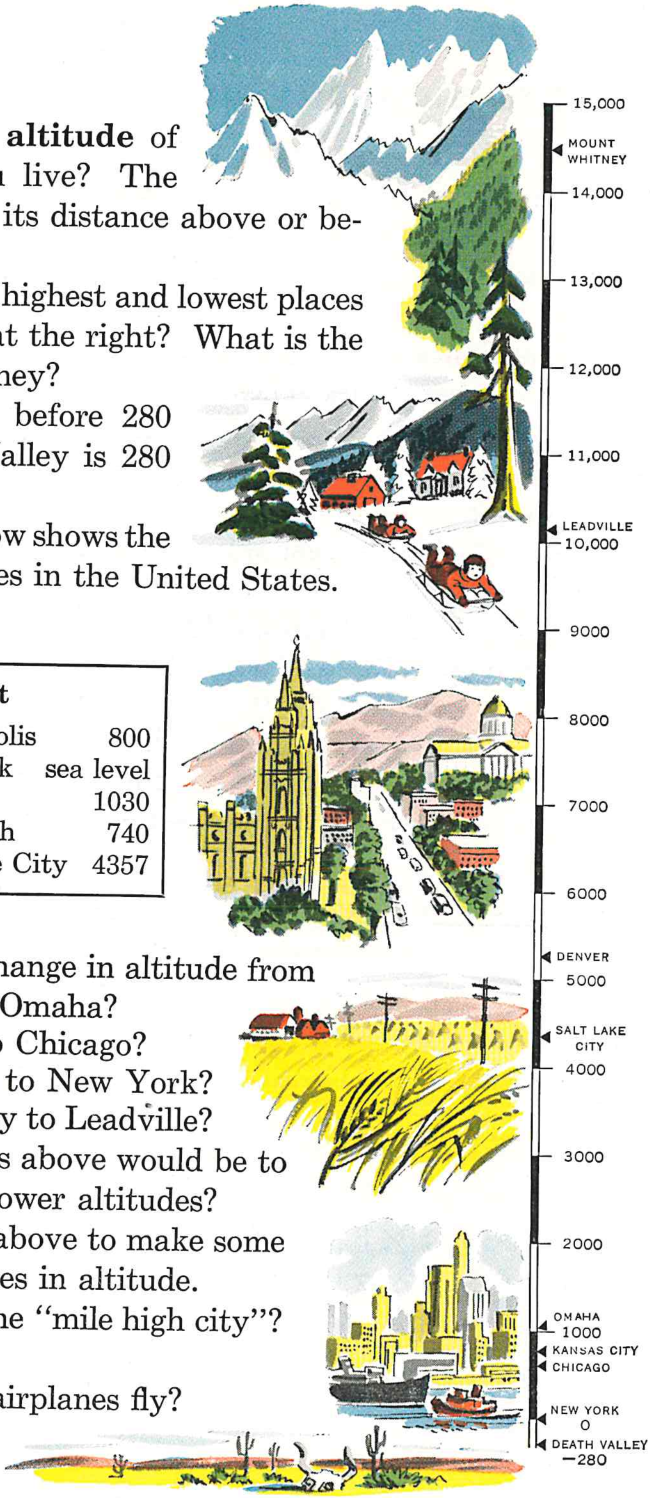
a. Denver to Omaha?
b. Houston to Chicago?
c. Pittsburgh to New York?
d. Kansas City to Leadville?

5. Which changes above would be to higher altitudes? to lower altitudes?

6. Use the table above to make some problems about changes in altitude.

7. What city is the "mile high city"? Why?

8. How high do airplanes fly?



SEVENS AND EIGHTS

	4	5	6	7	8	9
4	16	20	24	28	32	36
5	20	25	30	35	40	45
6	24	30	36	42	48	54
7	28	35	42	?	?	63
8	32	40	48	?	?	72
9	36	45	54	63	72	81

Here's a surprise!

First, you learned the nines.

Then you learned the fours and the sixes. You know the fives.

The surprise? You have only 4 multiplication facts left to learn for the experiment. These are: 7×7, 7×8, 8×7, and 8×8 Which two products will be the same?

1. The easiest way to learn two of these is by memorizing.

a. 7 sevens are 49. Then you can reason that 7 more than 49 is 56. $8 \times 7 =$?

b. $8 \times 8 = 64$. 8 less than 64 is 56. $7 \times 8 =$?

2. If 7 sevens are 49, how many are 8 sevens?

3. If 8 eights are 64, how many are 7 eights?

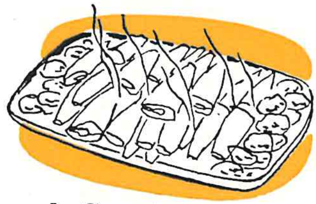
4. If $7 \times 8 = 56$, then $8 \times 7 =$? .

QUESTIONS FOR THE ANSWER STRIP (Division optional)

(1)	(10)	(19)	(28)	(1)	(10)	(19)	(28)
6×9	8×5	9×4	5×7	$54 \div 6$	$40 \div 8$	$36 \div 9$	$35 \div 5$
7×6	4×9	6×7	6×8	$42 \div 7$	$36 \div 4$	$42 \div 6$	$48 \div 6$
5×9	8×6	4×5	9×6	$45 \div 5$	$48 \div 8$	$20 \div 4$	$54 \div 9$
7×8	5×4	8×8	7×5	$56 \div 7$	$20 \div 5$	$64 \div 8$	$35 \div 7$
6×6	7×9	4×7	4×6	$36 \div 6$	$63 \div 7$	$28 \div 4$	$24 \div 4$
7×4	5×8	5×6	8×9	$28 \div 7$	$40 \div 5$	$30 \div 5$	$72 \div 8$
4×8	7×7	8×7	4×4	$32 \div 4$	$49 \div 7$	$56 \div 8$	$16 \div 4$
5×5	8×4	9×5	9×7	$25 \div 5$	$32 \div 8$	$45 \div 9$	$63 \div 9$
9×8	9×9	6×4	6×5	$72 \div 9$	$81 \div 9$	$24 \div 6$	$30 \div 6$

SCOUT TREASURER—U. S. A.

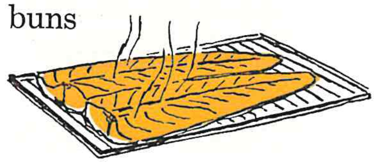
Suppose you are the Scout treasurer in different parts of our country. You are to collect for a Saturday noon cook-out for 10 Scouts and 2 visitors who are not allowed to pay.



1. *A fish fry in the South*: For dipping the fish we caught and for hush puppies, 50¢ worth of corn meal; 3 lb. of deep fat at 26¢ a lb.; relish, 29¢; cabbage, 28¢; two dozen rolls at 30¢ a doz. Find the cost for each Scout.

2. *A corn roast in the East*: A big fire in a pit ... hot coals ... cover with dirt ... lay on corn in husks ... more dirt ... sweet, juicy roasting ears. Two dozen ears at 45¢ a dozen; butter for 80¢; potato chips at $1.17; ice cream at $1.20. How much for all?

3. *A salmon roast in the Northwest*: Dad gave the salmon he caught. Potato chips, $1.56; 24 buns at 30¢ a dozen; 2 watermelons at 60¢ each; 2 boxes of marshmallows at 33¢ a box. How much for all? How much for each Scout?



4. *A weiner roast anywhere*: How much for all? How much for each? 3 bags of potato chips at 39¢; 24 weiners (3 lb.) at 75¢ a lb.; 2 boxes of marshmallows at 35¢ a box; 2 dozen buns at 30¢ a dozen.

UNDERSTAND AND PRACTICE MULTIPLICATION FACTS

You have studied all of the multiplication facts in the experiment. You may need to practice some of them every day until the end of the experiment.

My Record on Some Multiplication Facts

	1	2	3	4	5
4 × 6					
4 × 7					
4 × 8					
4 × 9					
5 × 6					
5 × 7					
5 × 8					
5 × 9					
6 × 4					
6 × 5					
6 × 6					
6 × 7					
6 × 8					
6 × 9					
7 × 4					
7 × 5					
7 × 6					
7 × 7					
7 × 8					
7 × 9					
8 × 4					
8 × 5					
8 × 6					
8 × 7					
8 × 8					
8 × 9					
9 × 4					
9 × 5					
9 × 6					
9 × 7					
9 × 8					
9 × 9					

Make a record sheet with the 32 questions at the left. Make twelve columns. Every time you use the answer strip, mark (x) after each question you miss. Then you will know which ones you must understand better and practice more.

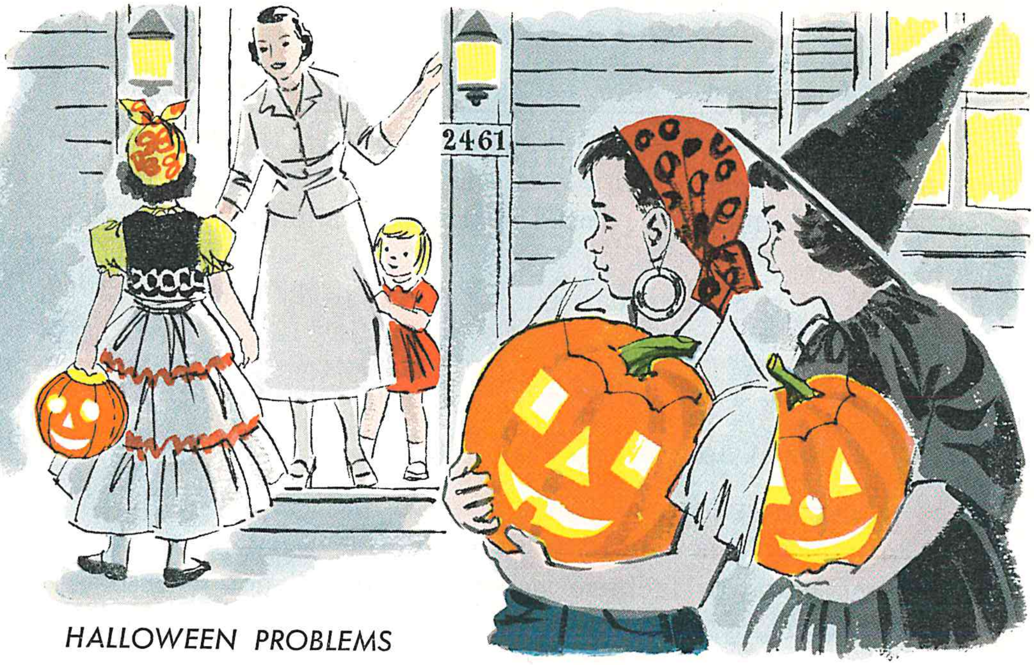
When you study facts you miss, turn to pages 54, 56, and 58 to understand how the products are found.

Keep your record. You will use it several times after this experiment has been finished.

PRACTICE

Multiply.

1.	$\begin{array}{r}897\\ \underline{4}\end{array}$	$\begin{array}{r}967\\ \underline{7}\end{array}$	$\begin{array}{r}796\\ \underline{5}\end{array}$	$\begin{array}{r}986\\ \underline{8}\end{array}$
2.	$\begin{array}{r}976\\ \underline{6}\end{array}$	$\begin{array}{r}864\\ \underline{9}\end{array}$	$\begin{array}{r}984\\ \underline{7}\end{array}$	$\begin{array}{r}976\\ \underline{9}\end{array}$
3.	$\begin{array}{r}869\\ \underline{5}\end{array}$	$\begin{array}{r}785\\ \underline{8}\end{array}$	$\begin{array}{r}478\\ \underline{6}\end{array}$	$\begin{array}{r}754\\ \underline{9}\end{array}$
4.	$\begin{array}{r}685\\ \underline{7}\end{array}$	$\begin{array}{r}869\\ \underline{4}\end{array}$	$\begin{array}{r}956\\ \underline{8}\end{array}$	$\begin{array}{r}568\\ \underline{6}\end{array}$



HALLOWEEN PROBLEMS

Number an answer sheet and write the answers:

1. What shapes do you see in the picture?

2. Mike, a boy who lives at this house, wanted candy and gum to give for treats. Mother estimated that there would be 25 visitors. Mike will spend about 5¢ for each. How much money is that for treats?

3. Mike buys 25 chocolate mints at 2¢ each, 5 packages of gum at 5¢ a package, and a bag of paper-wrapped pieces of chocolate for 39¢. How much money will be left from $1.25?

4. If 30 or 40 children come instead of 25, what should Mike's mother do? If she says to the later children, "I am sorry, but we have run out of treats," should they play tricks?

5. Write Mike's house number in words. Is it odd or even?

6. Write the day of the week, the month, day of the month, and the year for this Halloween. Use abbreviations.

UNDERSTANDING CARRY FACTS IN MULTIPLICATION

1. When you multiply, you often need to carry a number to the next column on the left. See Example *A*.

What number is carried to the tens' column?

$24 + 5 = \underline{\ ?\ }$

What number is carried to the hundreds' column?

$18 + 2 = \underline{\ ?\ }$

A

$$\begin{array}{r} {\scriptstyle 2\ 5\ } \\ 349 \\ 6 \\ \hline 2094 \end{array}$$

$24 + 5 = 29$ and $18 + 2 = 20$ are called **carry facts.**

2. What are the carry facts in *B*?

B

$$\begin{array}{r} 743 \\ 7 \\ \hline \end{array}$$

You have learned that when you multiply by 2-digit multipliers, it is confusing to write the carry numbers. Learn the carry facts so well that you will not need to write the carry numbers.

3. $2 + 5 = 7$, so $12 + 5 = \underline{\ ?\ }$

4. Finish these carry facts. Is the sum of the ones' digits under 10? Does the tens' digit change?

$54 + 3 =$ $\quad$ $36 + 2 =$ $\quad$ $21 + 5 =$ $\quad$ $45 + 2 =$

5. $6 + 4 = 10$, so $16 + 4 = \underline{\ ?\ }$

6. $7 + 5 = 12$, so $27 + 5 = \underline{\ ?\ }$

7. $8 + 5 = 13$, so $28 + 5 = \underline{\ ?\ }$

8. Finish these carry facts. Is the sum of the ones' digits 10 or more? Does the tens' digit change?

$16 + 4 =$ $\quad$ $27 + 5 =$ $\quad$ $72 + 8 =$ $\quad$ $36 + 5 =$

9. Look at these quickly and tell what the tens' digit will be:

a. $24 + 5$	**e.** $63 + 6$	**i.** $24 + 7$
b. $35 + 6$	**f.** $28 + 2$	**j.** $56 + 5$
c. $27 + 7$	**g.** $42 + 6$	**k.** $27 + 3$
d. $54 + 4$	**h.** $49 + 2$	**l.** $36 + 3$

PRACTICING THE CARRY FACTS

To learn carry facts for multiplication, you practice adding to numbers that are products. You will not need much practice on such facts as 20 + 4 or 64 + 5, because the tens' digit does not change.

Practice. To each product below add in turn each number that follows the multiplication:

$7 \times 2 +$	6	$9 \times 5 +$	5, 6, 7, 8
$8 \times 2 +$	4, 5, 6, 7	$8 \times 6 +$	2, 3, 4, 5, 6, 7
$9 \times 2 +$	2, 3, 4, 5, 6, 7, 8	$7 \times 7 +$	1, 2, 3, 4, 5, 6
$8 \times 3 +$	6, 7	$9 \times 6 +$	6, 7, 8
$9 \times 3 +$	3, 4, 5, 6, 7, 8	$8 \times 7 +$	4, 5, 6, 7
$7 \times 4 +$	2, 3, 4, 5, 6	$9 \times 7 +$	7, 8
$7 \times 5 +$	5, 6	$8 \times 8 +$	6, 7
$9 \times 4 +$	4, 5, 6, 7, 8	$9 \times 8 +$	8

Do you think of the ones or tens first?

	a	b	c	d
1.	28 and 5	45 and 7	63 and 5	45 and 8
2.	64 and 7	27 and 2	54 and 6	49 and 2
3.	36 and 8	49 and 6	16 and 3	36 and 6
4.	49 and 4	27 and 8	36 and 5	48 and 6
5.	63 and 8	35 and 4	48 and 7	49 and 5
6.	42 and 6	64 and 6	63 and 7	56 and 5
7.	54 and 8	56 and 7	56 and 4	36 and 4
8.	35 and 6	35 and 5	48 and 3	48 and 4
9.	49 and 3	54 and 7	27 and 6	25 and 3
10.	56 and 6	72 and 8	45 and 6	36 and 7

THE ANSWER STRIP

Use the facts above for practice with an answer strip.

MORE STUDY AND MORE PRACTICE

Your teacher will have ways of finding which multiplication facts most of the class need to study. Children who know the facts very well may do page 65.

These 12 facts are often difficult for many children. Are your difficult ones among them?

6 nines	7 eights	7 sixes	8 sixes
4 eights	4 nines	7 nines	7 sevens
6 sevens	4 sevens	7 fives	5 nines

Do you have trouble with 8×8, 9×7, 9×6, or 8×7?

After you study and practice the facts above orally, use an answer strip with them.

Set 1

Multiply:

	a	b	c	d	e	f	g	h	i
1.	48	68	85	86	47	79	56	84	96
	6	4	7	5	8	6	9	7	8
2.	86	56	97	64	79	95	58	67	74
	8	6	9	7	4	9	8	6	8
3.	97	86	94	95	68	47	57	79	96
	7	9	6	8	5	9	7	5	7

Set 2

Multiply:

	a	b	c	d	e	f	g
1.	763	578	985	479	458	867	964
	8	7	6	7	9	6	9
2.	876	479	568	976	678	687	589
	7	9	9	8	9	8	9

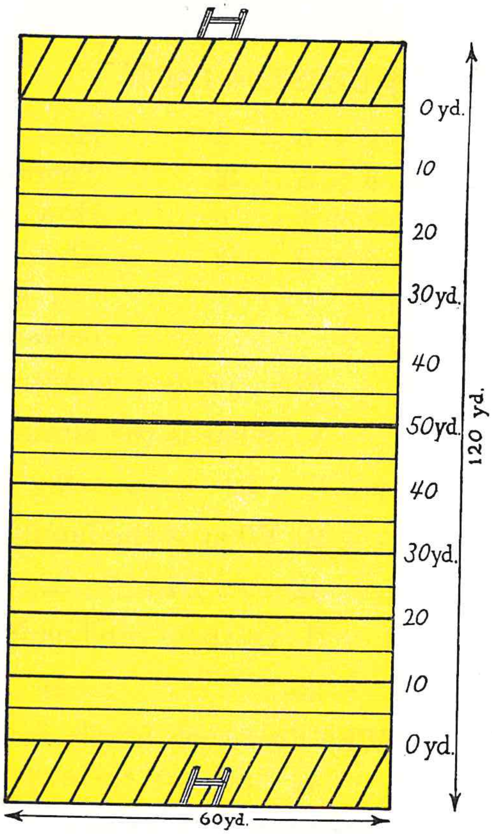
A FOOTBALL FIELD

Joe and his friends live in a small city. Joe lives near a pasture. The owner said the boys could use it for a football field. Joe's dad will help them make one. They decide to make everything half size.

Answer these on an answer sheet:

1. How long is the field in the picture without the end zones? The end zones are marked with *oblique* lines.

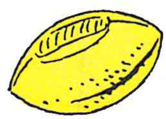
2. Write the meaning of *oblique* in your own words. Use the dictionary if you need it.



3. How many yards long will the boys' field be with end zones? How many feet long? Is it to be made full size or half size?

4. How wide will it be in yards? in feet?

5. On the big field how many yards is it from one 30-yd. line to the other 30-yd. line?



6. The real goal posts are 20 ft. apart and the cross bar is 10 ft. high. What will a half-size goal measure?

7. "How many people go to a big college game, Dad?" asked Joe. "Sometimes 100,000," said Dad. What is half of 100,000? Write it down. "We'll be lucky to have a half-dozen," said Joe.

Joe's dad reminded the boys before their first game that fifth grade boys play touch football. "They never tackle. They never half tackle, either," he said.

DIVISION FACTS

$48 \div 6 = 8$
$8 \times 6 = 48$
$48 \div 8 = 6$
$6 \times 8 = 48$

How many sixes are there in 48?
There are 8 sixes in 48.
How many eights are there in 48?
There are 6 eights in 48.

These two questions and answers are parts of the same family of 6, 8, and 48.

Every product number has its own family.

1. What is the family of 32?

$4 \times 8 = 32$ $\quad 32 \div 8 = 4$ $\quad 8 \times 4 = 32$ $\quad 32 \div 4 = 8$

2. What is the family of each of these products?

42 54 30 56 63 72 35

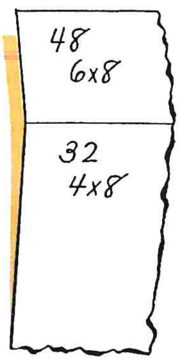
3. Of these products?

25 49 64 81

Why does each family in Ex. 3 have just 2 facts?

4. Each of these products has 2 different families. What are they?

12 24 36



5. Use folded paper to write the two digits whose products are these numbers. Write them under the numbers.

48	54	42	63	36	36	45
32	30	56	72	81	35	49

6. Use folded paper to practice these divisions:

a.	$6\overline{)30}$	$4\overline{)28}$	$7\overline{)35}$	$8\overline{)32}$	$6\overline{)24}$	$9\overline{)36}$	$7\overline{)49}$
b.	$8\overline{)56}$	$6\overline{)48}$	$9\overline{)54}$	$7\overline{)42}$	$9\overline{)81}$	$5\overline{)45}$	$8\overline{)40}$
c.	$7\overline{)56}$	$9\overline{)72}$	$6\overline{)36}$	$4\overline{)32}$	$8\overline{)48}$	$9\overline{)63}$	$7\overline{)28}$
d.	$6\overline{)42}$	$8\overline{)72}$	$7\overline{)63}$	$9\overline{)45}$	$4\overline{)24}$	$8\overline{)64}$	$6\overline{)54}$

PRACTICE FOR THE EXPERIMENT

Set 1. Multiplications for the answer strip

(1)	(8)	(15)	(21)	(27)
6 fives	7 sevens	5 nines	6 sixes	9 sevens
4 sevens	6 eights	9 sixes	7 nines	8 sixes
5 eights	9 fours	4 nines	5 sevens	7 fours
8 fours	7 sixes	8 fives	9 eights	6 sevens
7 fives	8 sevens	7 eights	6 nines	8 nines
6 fours	9 nines	9 fives	4 eights	5 sixes
8 eights	4 sixes			

Remember to mark your chart.

Set 2. Carry facts for the answer strip

(1)	(8)	(15)	(22)	(29)
28 and 3	63 and 7	35 and 6	64 and 7	54 and 3
35 and 5	56 and 4	72 and 8	32 and 7	45 and 8
56 and 6	48 and 7	49 and 3	36 and 6	56 and 7
42 and 6	36 and 5	28 and 6	24 and 7	48 and 4
16 and 7	63 and 8	16 and 4	49 and 4	49 and 6
48 and 5	45 and 4	49 and 2	56 and 5	36 and 8
45 and 6	54 and 8	45 and 5	64 and 6	45 and 7

Set 3. Multiply. Use folded paper.

	a	b	c	d	e	f	g
1.	785 8	685 6	479 9	586 7	684 6	574 8	469 5
2.	658 9	597 7	968 4	896 8	894 6	764 9	964 7
3.	586 9	897 4	469 8	497 9	476 7	859 5	648 8

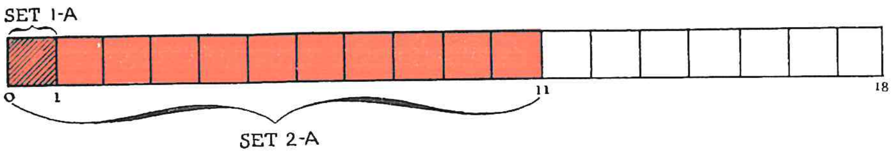
THE FINAL TESTS

1\. *Taking the tests.* Take the final tests to see how much you gained. (Teacher: See page 53.)

2\. *Comparing Results*:

a\. Compare with your own work done earlier. Have you gained? What is the difference between your scores on the first and last tests?

b\. In one class each pupil made his own charts. Here is the way Helen's charts looked:

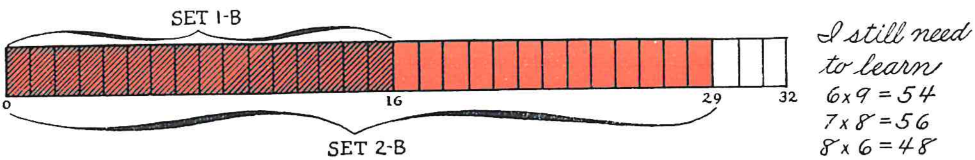


Multiplication Examples:

There were 18 examples. Helen had 1 right on the first test. She had 11 right on the final test. What was her gain?

Multiplication Facts:

There were 32 facts. Helen had 16 right on the first test and 29 right on the final test. She wrote the three facts that she still needs to learn.

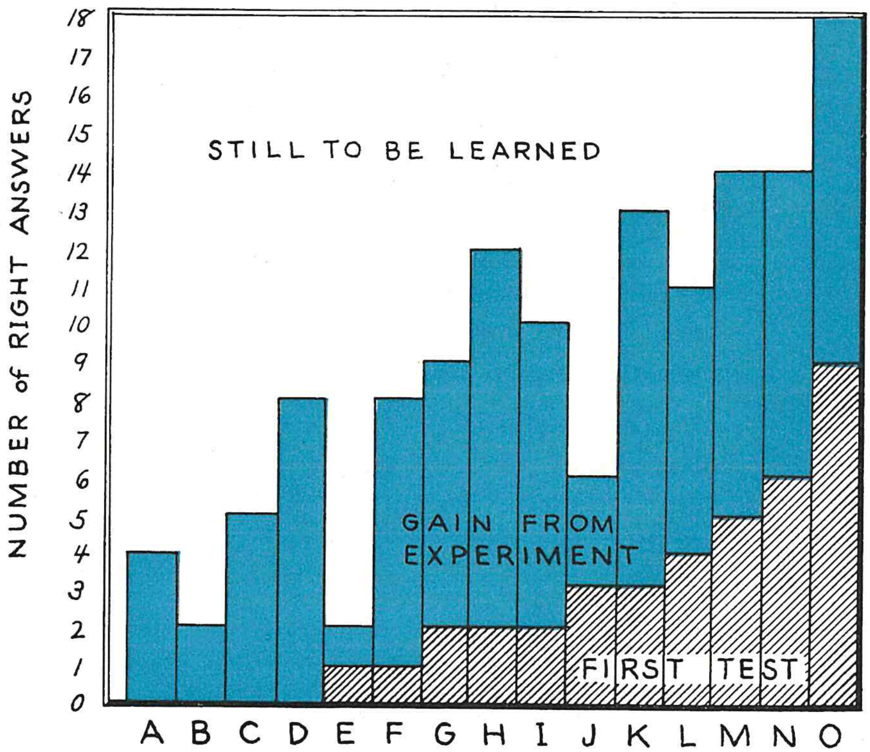


c\. Each pupil in another class just marked the facts he missed on a chart like the one you made for page 60, and kept right on trying to learn them.

A CHART OF RESULTS

Charts help a person to see results quickly. Miss Lane made this chart for her class. She did not show it to the children with their names on it. Scores for just a part of the pupils are shown here.

TEST RESULTS—MULTIPLICATION EXAMPLES



(Letters stand for names of children.)

1. Pupils *A*, *B*, *C*, and *D* had none right on the first test. Which one of them had 8 right on the final test?

2. Pupil *H* had 12 right on the final test. What did he gain?

3. Who had most right on both tests?

4. Ask questions and tell things from the chart.

UNIT 5

THE MEANING AND USE OF NUMBERS

TWO KINDS OF NUMERALS

ROMAN	MODERN
	0
I	1
II	2
III	3
IV	4
V	5
VI	6
VII	7
VIII	8
IX	9
X	10
XI	11
XII	12
XIII	13
XIV	14
XV	15
XVI	16
XVII	17
XVIII	18
XIX	19
XX	20
XL	40
L	50
LX	60
XC	90
C	100

The figures we use to stand for numbers are called **numerals.** Digits are numerals.

Thousands of years ago, the different peoples of the world used different ways of writing numbers. Today, most of the people of the world use numerals similar to the ones we use.

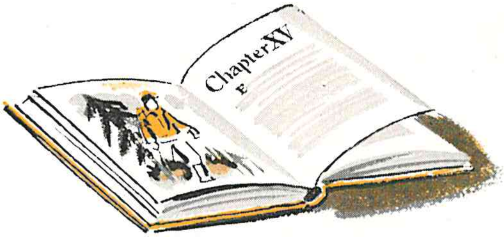
Our modern digits have developed from numerals first used by people in India long, long ago. They are sometimes called Arabic numerals because they were brought to Europe by way of Arabia.

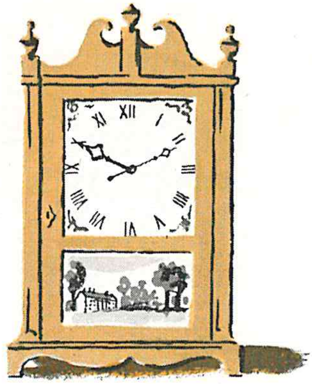
Roman numerals are sometimes used today. Find some ways in which they are used.

Use Roman numerals to write each example below. Now try to work one. Impossible?

Add	Subtract	Multiply	Divide
28	49	13	
12	21	4	3)24

Is it easier to use Roman numerals or our modern numerals?





▶ USING ROMAN NUMERALS

In what ways have you found Roman numerals being used?

Write these numbers with modern digits:

	a	b	c	d	e
1.	VI	X	IX	IV	XIV
2.	VII	XI	XII	XVI	XX
3.	XVIII	XIX	XXV	XXIX	XXIV
4.	L	LX	XL	XLI	LXI
5.	LXX	C	CX	XC	XCV

Write these numbers with Roman numerals:

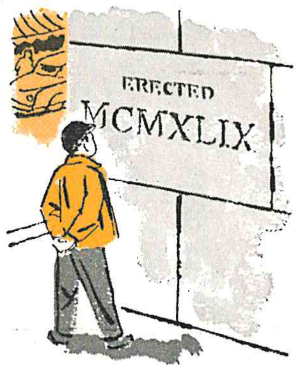
	a	b	c	d	e
1.	3	5	6	4	7
2.	10	9	11	12	8
3.	15	14	16	13	17
4.	20	21	19	50	100

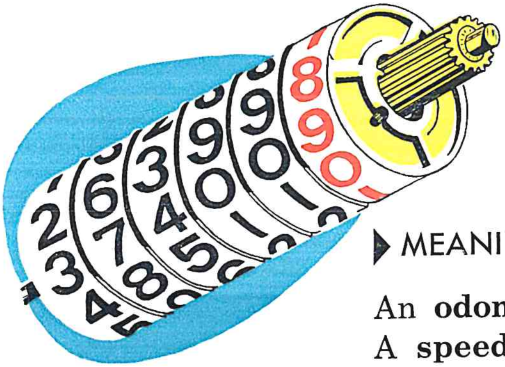
● Have you noticed that Roman numerals have no zero? Zero was a wonderful invention. It makes it possible to write numbers as large as we want, and to multiply and divide easily.

How many is 10×23? 10×16?

How many is X × XIV? X × XVI?

Can you multiply these without changing to our numerals? Do you see why the Romans used an abacus for multiplying?





MEANING OF PLACE VALUE

An **odometer** measures distance.
A **speedometer** measures speed.
They are built together in an automobile, so some people say "speedometer" for both.

This picture shows the inside wheels of an odometer. The wheels turn at different times. When any wheel turns 10 times, a little cog comes around and turns the wheel at the left just one number space. The red figures are tenths of a mile. The top row shows in the odometer's window. When the red zero comes up next, how many other places will change?

Each wheel has the same digits, but where the digits are placed makes much difference in their value.

1 This number is worth how much?
10 This number is how many times as large?
100 How many times as large again?
1 000 Read this number.
10,000 How many times as large is this number?
100,000 This 1 stands for how many?
1,000,000 The place value of this 1 is a thousand thousand.
The number's name is **one million.**
Is it $10 \times 100{,}000$? $100 \times 10{,}000$? 1000×1000?

● *Every digit is a place holder.*

1. 5682 Which place is held by the 6? by the 8?
2. 9405 Which place is held by the zero? by the 9?
3. 4075 Which digit holds hundreds' place? tens'?
4. 8216 Which digit holds thousands' place? ones'?

READING LARGE NUMBERS

1. Which of these numbers is easier to read:

100000 or 100,000? 64758 or 64,758?

Commas divide numbers into groups to make them easier to read.

2. Can you read 243,243,243?

243 The first group, at the right, is the *ones'* group. This number has 200 ones, 40 ones, and 3 ones. It is 243.

243,000 The second group is the *thousands'* group. This number has 200 thousands, 40 thousands, and 3 thousands. It is 243 thousand.

243,000,000 The next group is the *millions'* group. This number has 200 millions, 40 millions, and 3 millions. It is 243 million.

Remember the three groups above. When you read numbers, you do not say the ones, but just "two hundred forty-three."

Millions

Thousands

22,356,243

This number is read, Twenty-two million, three hundred fifty-six thousand, two hundred forty-three.

3. Read these numbers.
You do not say the zeros.
Do not say *and.*
Do not put *s* on million or thousand.

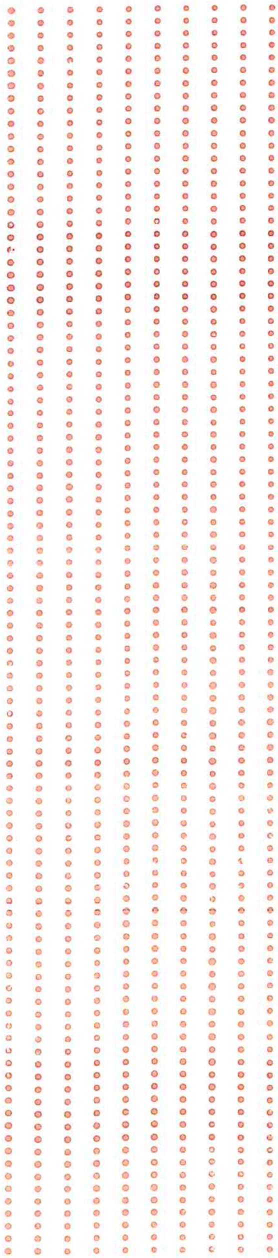
6,425,672
4,652,041
15,403,506
3,003,003

4. What is the value of the 2 in each number below?

a. 4627 **b.** 26,439 **c.** 1,258,967 **d.** 12,647,591

5. Where should the commas be in these numbers?

a. 314657 **b.** 42783609 **c.** 2765481 **d.** 574930826



HOW MANY IS A THOUSAND?

You can count to a thousand. Can you imagine what a thousand of something would be? There are one thousand dots at the left of this page. Each row has 10 dots. How many dots are in each column? How big would a pile be if these dots were grains of sand? How thick are 1000 sheets of writing paper?

1. Some schools have 1000 children. How many has your school?

2. How many people live in your town?

3. How many people can be seated in your gymnasium, or auditorium, or church?

4. Do you listen to radio reports of football games or see them on television? How many people does a big stadium hold?

Think these answers without using pencil and paper:

5. How many bicycles at $50 each can be bought with $1000?

6. Bob's mother and father together earn $4800 a year. They want to buy an automobile that costs $2000. After they pay for food, clothes, rent, and other expenses, they have $50 left each month. How many months will it take them to save $2000 for a car?

THINKING OF A MILLION

Scientists often work with millions, or with even larger numbers. They figure distances to stars. They also count tiny germs. They figure the pounds a bridge will hold. They measure the speed of light. They estimate the age of the earth.

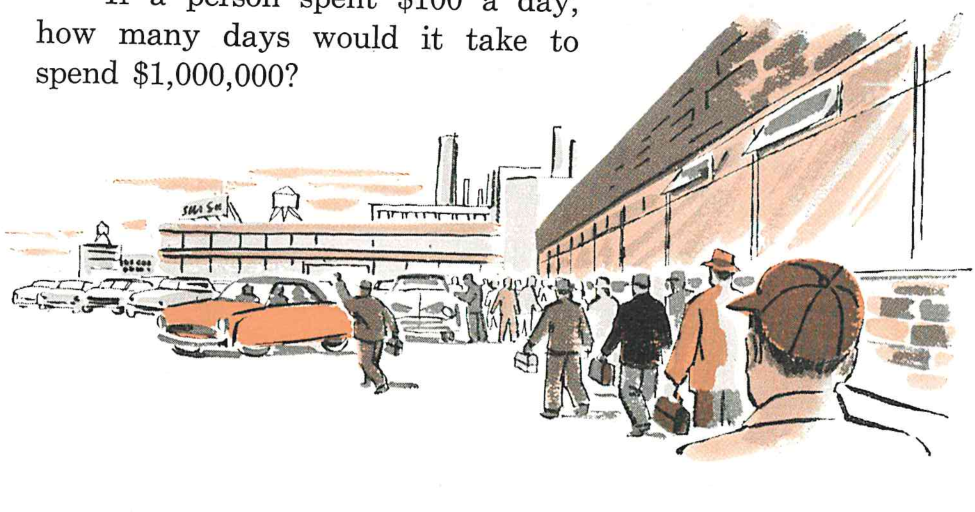
Most people think of millions when they think of people and of dollars. Here are the numbers of people in some of our cities:

About	8,000,000	New York	Each about 2,000,000	Detroit, Los Angeles, Philadelphia
Nearly	4,000,000	Chicago		

1. Can you make a list of cities in the United States that have over a half million people? Look for them in the *World Almanac, Information Please Almanac,* an atlas, or a geography book.

2. A million dollars ($1,000,000) is hard to imagine. Some big companies pay $1,000,000 a day to their employees. Some states spend many millions of dollars every year to build roads. A million dollars isn't much with which to buy food and clothes for all the people, nor to run all their automobiles. But it would be a lot for some one your age to try to spend.

If a person spent $100 a day, how many days would it take to spend $1,000,000?



WRITING LARGE NUMBERS

1. Write the following numbers with digits. Remember to use commas to show the groups of thousands and of millions, if there are millions. You should not use commas in 4-place numbers.

a. Five million, three hundred sixty-one thousand, eight hundred forty-seven.

b. Twelve million, six hundred ten thousand, two hundred twenty-four.

c. Thirty-eight thousand, fifty-six.

d. Two hundred six thousand, four hundred.

e. Sixty thousand, four hundred twenty-five.

f. Ten thousand, eight.

g. Nineteen hundred sixty.

h. Thirty-two hundred.

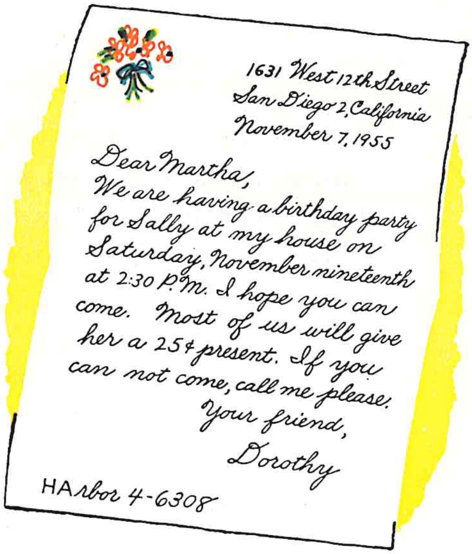
2. Explain how the pairs of examples below were done:

a		b		c	
16	16	240	240	608	608
3	30	4	40	2	20
48	480	960	9600	1216	12,160

3. When there are no ones in the multiplier, what do you write in ones' place in the product?

4. Multiply. Use commas in answers of more than 4 places.

a. 430	**b.** 350	**c.** 907	**d.** 406	**e.** 400
30	50	40	50	60
f. 820	**g.** 385	**h.** 523	**i.** 709	**j.** 640
50	70	90	60	80



1631 West 12th Street
San Diego 2, California
November 7, 1955

Dear Martha,

We are having a birthday party for Sally at my house on Saturday, November nineteenth at 2:30 P.M. I hope you can come. Most of us will give her a 25¢ present. If you can not come, call me please.

Your friend,

Dorothy

HArbor 4-6308

WRITING AND READING LETTERS

You do not say "hundred" in street numbers. You say *Sixteen thirty-one, West Twelfth Street, San Diego two, California.*

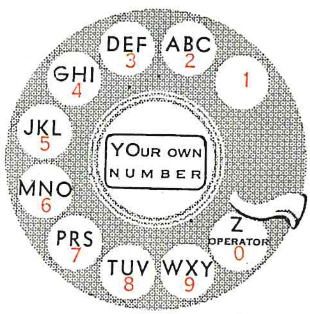
If you have forgotten Dorothy's exact street number, you could say, "She lives somewhere in the sixteen hundred block."

You read the date this way, "*November seven* (or seventh), *nineteen fifty-five.*"

Sometimes dates are written this way: 11–7–55. This means the *eleventh month*, the *seventh day* of the month, *1955.* You do not use this form in letters.

You say Dorothy's telephone number this way: "Harbor four, six three oh eight." The oh means zero, but in telephone numbers it is said as if it were a letter.

People have so many incorrect ways of saying zero, as naught, ought, and cipher, that everybody understands better if all call it "oh" in telephone numbers. You must watch telephone dials or you will mix the letter *O* and zero.



NUMBERS FOR NAMES—IDENTIFICATION

Identify means "to tell which." Mr. Smith has a very good job in a large factory. The factory has many thousands of people working. Sixteen people named Smith work there. Four of them are called Jim Smith. But there is only one number **6427.** It is for only one Jim Smith.

Numbers are used by factories, insurance companies, mail-order houses, and government and other offices to identify people better. There are many more numbers than there are names. Numbers can be put in order quickly, so they help identify people easily.

Nearly everyone who works for wages or a salary has a *social security* number so that his account will not get mixed.

An automobile license number is like a name. Names are too long for tags and too hard to make. The number identifies the owner.

TRAINS ARRIVING		
NO.	TIME	
104	11:20 A.M.	ON TIME
75	3:15 P.M.	ON TIME

Trains have numbers to tell which you mean. If you ask for the train to Chicago, it is hard to tell which train is meant. A few trains have names. All trains have numbers.

SPring 8-3100

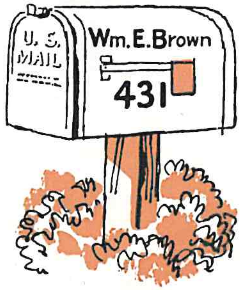
"Spring-eight, three, one hundred" may be somebody's telephone number. No two telephones in the same town have the same number.

What does "identify" mean? How do numbers help?

NUMBERS TO LOCATE

Locate means "to tell where."

1. "Twenty-second Street," calls the bus driver. Is it time to get ready to leave the bus if you are going to 24th Street?



2. Your friend lives at 1241 East 24th Street. As you walk, you read the number 1237. How can you tell that you are close?

Do you remember that **even** numbers divide evenly by 2, but **odd** numbers have a remainder when divided by 2?

3. Do you have a rural or a city mail carrier? How do numbers help him deliver the mail?

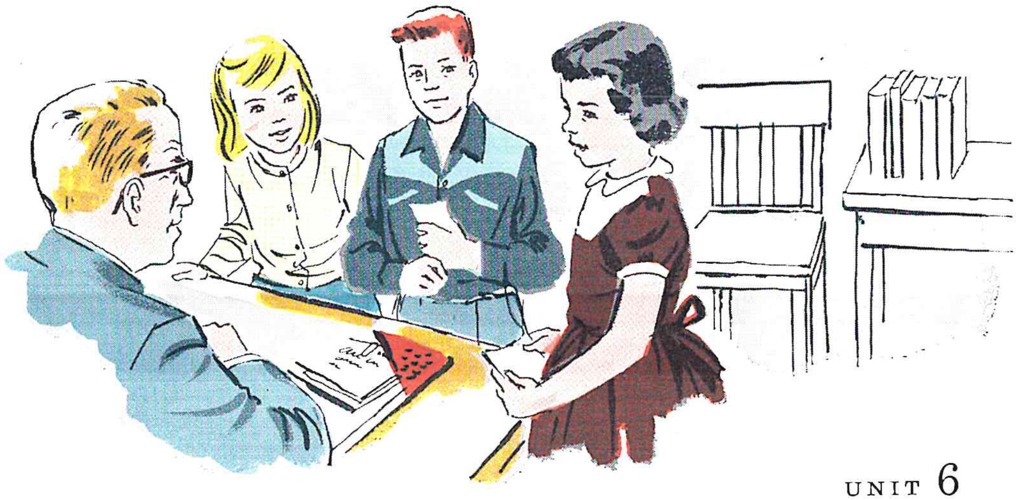
4. These are the map locations for five cities. Which two cities are in the same section of the map? →

Baker	A	6
Bender	C	4
Bolen	B	2
Burt	C	4
Cardiff	E	6

5. "Our seats are Row H, Numbers 14, 16, and 18," said Dad. Why, do you think, are seats with odd numbers across the aisle?

GROWTH TEST

1. 933 − 387
2. 189 ÷ 3
3. 7 + 7 + 8 + 5
4. 7 × 53
5. 6 × 451
6. 6749 + 9576
7. 209 ÷ 4
8. 1264 − 370
9. 9 × 569
10. 344 ÷ 8
11. 34 × 89
12. 285 ÷ 7
13. $\frac{1}{4}$ × 24
14. 448 ÷ 5
15. 6095 − 5328
16. 8 × 2705
17. 1412 − 467
18. 16 × 897
19. 827 + 96 + 468 + 59
20. 509 + 1369 + 97



UNIT 6

RELATIONSHIPS IN MULTIPLICATION AND DIVISION

MULTIPLIER-MULTIPLICAND-PRODUCT RELATIONS

1. Bayview School has three fifth grades. Each fifth grader has paid 30¢ for the class newspaper. The principal called the class treasurers together to check the money and total it. This is the report:

PEG'S	JOE'S	ANN'S
\$ .30	\$ .30	\$ .30
31	29	33
30	270	90
90	60	90
\$9.30	\$8.70	\$9.90

Peg for Miss Lane's room, 31 at 30¢ each	→	\$ 9.30
Joe for Miss King's room, 29 at 30¢ each	→	8.70
Ann for Mr. Bush's room, 33 at 30¢ each	→	9.90
	Total	\$27.90

Joe says, "I know how we can check another way. Add the number of people, and multiply 30¢ by the total number." How many people are there all together?

31		
29		
33		\$.30
93	→	93
		90
		270
		\$27.90

2. If the multiplicand stays the same and the multiplier increases, what happens to the product?

Same multiplicand →	12	12	12	12	12
Multiplier increases →	1	2	4	8	16
Product _?_.	12	24	48	96	192

3. If the multiplicand increases while the multiplier stays the same, what happens to the product?

Multiplicand increases →	2	4	8	16	32
Multiplier stays the same →	3	3	3	3	3
Product _?_.	6	12	24	48	96

4. How many times as much money at 30¢ each should be collected from 12 pupils as from 4 pupils?

5. If $2.40 is collected when the cost is 30¢ each, how much should be collected from the same number of people when the cost is doubled?

USING RELATIONSHIPS

1. Peg's job on the class newspaper is to estimate the costs. She has found that the paper for 4 pages will cost $1.20. What will it cost if there are 8 pages? 6 pages?

2. The mimeograph stencils for 4 pages will cost about 60¢. What will be the cost for 8 pages? for 6 pages?

3. Hectograph stencils cost about $\frac{1}{4}$ as much as mimeograph stencils. When the total cost of mimeograph stencils is $1.20, what will be the cost of hectograph stencils?

4. One kind of paper will cost $1.60. Another kind that is twice as expensive will cost how much?

5. About $\frac{1}{3}$ of each column on page 1 will be used for a picture. How many lines will be left in each column for typed material? Each column has space for 60 lines.

THE ANSWER STRIP

Use column **a**, page 94.

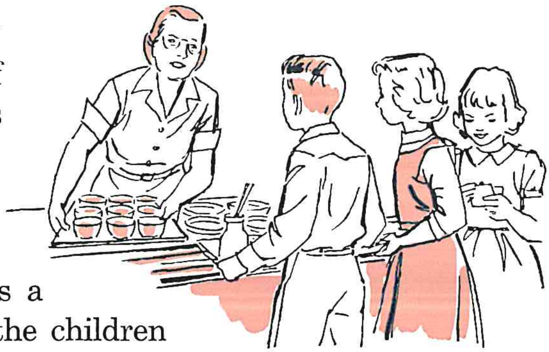
M-M-P RELATIONSHIPS

M-M-P means **multiplier-multiplicand-product** relations.

Number an answer sheet for 7 answers. In each sentence below, two words are put where there should be only one. Write the one word that makes the better sense.

1. Mrs. Marshall, who runs the school lunchroom, says she increases the milk order every Friday because **(more, fewer)** children eat at school that day.

2. Mrs. Marshall says that when she has two desserts instead of one, and children can choose one of them, she makes **(more, less)** of each.



3. Mrs. Marshall says if the cost of the food she buys gets cheaper, she will **(lower, raise)** the price for each pupil.

4. Miss Gordon teaches a one-room school where all the children walk to school. She says that those who live farthest away should start to school in the morning **(first, last)**.

5. If all the children start to school at the same time and arrive at the same time, those who live farthest away must go **(slowest, fastest)**.

6. Clara reads a book in 4 hours. Mary reads another one in 6 hours. If they both read at the same speed, **(Clara's, Mary's)** must have been the longer book.

7. Miss Lane says if each child everywhere uses one paper towel instead of two or three at a time, it will help save our forests for a **(longer, shorter)** time.

USING M-M-P RELATIONSHIPS

Set 1. Before you multiply, pick out the example in the first row that you think will have the largest product. Write its letter first. Then choose the one that will be next largest, and so on. Multiply to check your choices. Do the rest of the rows the same way.

	a	b	c	d	e
1.	37 47	52 47	98 47	43 47	65 47
2.	689 24	689 7	689 13	689 9	689 8
3.	507 8	507 4	507 7	507 9	507 6
4.	25 4	25 7	25 5	50 9	50 8

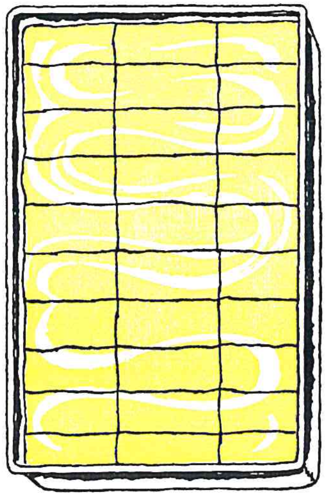
Set 2. Copy and multiply:

	a	b	c	d	e	f
1.	84 69	79 35	49 74	68 65	48 83	47 96
2.	74 58	69 93	95 96	39 85	36 69	56 85
3.	75 37	96 87	89 74	87 67	69 96	47 84

THE ANSWER STRIP

Use column **b**, page 94.

▶ DIVIDEND-DIVISOR-QUOTIENT RELATIONSHIPS



1. Miss Lane looked at the cake that Kathy's mother sent on Kathy's birthday. "Those pieces are really too big for us to eat. What does anyone suggest?" she asked. The children decided to share the cake with Mr. Casey's room. What happened to the size of each piece?

Which is the dividend? the divisor? the quotient?

a. Whole cake ÷ 30 = 

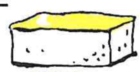
b. Whole cake ÷ 60 = 

Which one of them was the same in both divisions? What happened to the divisor? to the quotient?

Finish this rule: *When the dividend remains the same and the divisor increases, the quotient* _?_.

2. Bill said, "I am not suggesting this because I just want more cake, but we could save half for tomorrow."

Which stays the same this time? Finish this rule: *When the dividend decreases and the divisor stays the same, the quotient* _?_.

Whole cake ÷ 30 = 

Half cake ÷ 30 = 

3. You have $10 to spend for games to play. If you buy costly games, will you get more or fewer than if you buy cheaper games?

If the dividend remains the same and the divisor decreases, the quotient _?_.

÷ $5.00 = 2
÷ $2.00 = 5
÷ $1.00 = 10

D-D-Q RELATIONSHIPS

A		B		C			
$\begin{array}{r} Q \\ d\overline{)\text{SAME}} \end{array}$	$\begin{array}{r} 8 \\ 1\overline{)8} \end{array}$	$\begin{array}{r} Q \\ d\overline{)\text{SAME}} \end{array}$	$\begin{array}{r} 1 \\ 8\overline{)8} \end{array}$	$\begin{array}{r} Q \\ \text{SAME}\overline{)D} \end{array}$	D AND Q BOTH LARGER ↓	D AND Q BOTH SMALLER ↑	$\begin{array}{r} 1 \\ 2\overline{)2} \end{array}$
$\begin{array}{r} Q \\ d\overline{)\text{SAME}} \end{array}$	$\begin{array}{r} 4 \\ 2\overline{)8} \end{array}$	$\begin{array}{r} Q \\ d\overline{)\text{SAME}} \end{array}$	$\begin{array}{r} 2 \\ 4\overline{)8} \end{array}$	$\begin{array}{r} Q \\ \text{SAME}\overline{)D} \end{array}$			$\begin{array}{r} 2 \\ 2\overline{)4} \end{array}$
$\begin{array}{r} Q \\ d\overline{)\text{SAME}} \end{array}$	$\begin{array}{r} 2 \\ 4\overline{)8} \end{array}$	$\begin{array}{r} Q \\ d\overline{)\text{SAME}} \end{array}$	$\begin{array}{r} 4 \\ 2\overline{)8} \end{array}$	$\begin{array}{r} Q \\ \text{SAME}\overline{)D} \end{array}$			$\begin{array}{r} 4 \\ 2\overline{)8} \end{array}$
$\begin{array}{r} Q \\ d\overline{)\text{SAME}} \end{array}$	$\begin{array}{r} 1 \\ 8\overline{)8} \end{array}$	$\begin{array}{r} Q \\ d\overline{)\text{SAME}} \end{array}$	$\begin{array}{r} 8 \\ 1\overline{)8} \end{array}$	$\begin{array}{r} Q \\ \text{SAME}\overline{)D} \end{array}$			$\begin{array}{r} 8 \\ 2\overline{)16} \end{array}$

Say the rules for *A*, *B*, and *C* in your own words.

Choose the better of the two possible answers in each of the examples below:

1. There are to be three equal teams for games. As more children come to play, the number for each team gets **(larger, smaller.)**

2. You have a certain number of examples to do. The more you do in a minute, the **(more, fewer)** minutes it will take.

3. You have a dollar to spend. If you buy cheaper things, you will get **(more, fewer)** of them.

Which of these rules are *A*, *B*, and *C* above?

I. When the dividend remains the same and the divisor increases, the quotient decreases.

II. When the dividend remains the same and the divisor decreases, the quotient increases.

III. When the divisor remains the same, the dividend and quotient change together.

THE ANSWER STRIP

Use column **c**, page 94.

UNDERSTANDING DIVISION

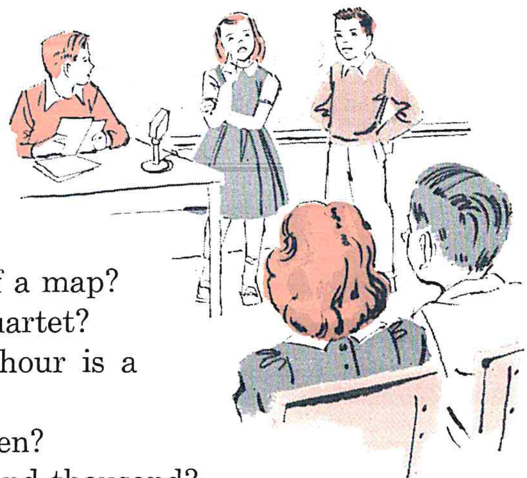
Set 1. List the letters in each row in order of the size the quotient is going to be. List the largest first, and so on. Then divide. The answer to Row 1 is **a, c, e, d, b.** Why?

	a	b	c	d	e
1.	2)1248	8)1248	3)1248	6)1248	4)1248
2.	7)1890	6)1890	5)1890	9)1890	3)1890
3.	9)4896	6)4896	4)4896	3)4896	8)4896
4.	4)3780	9)3780	6)3780	7)3780	5)3780

Set 2. Copy and divide:

	a	b	c	d	e
1.	9)8154	7)4256	4)3224	8)3272	7)6321
2.	3)1742	6)5645	8)5623	5)2902	9)6214
3.	5)2038	8)2469	6)4229	9)4565	7)7348
4.	9)7051	7)5241	4)1119	8)6147	6)6127

QUIZ SHOW



Here are several questions used for a quiz show in arithmetic. How many can you answer?

1. Which direction is the lower right-hand corner of a map?

2. How many are in a quartet?

3. How many miles an hour is a mile a minute?

4. How many are 12 dozen?

5. How many is a thousand thousand?

6. What 5 coins make 30¢?

7. Name the months that have 31 days.

ESTIMATING EARNINGS

Children will earn money for Christmas in different ways. Estimate the amount each will earn in one week in Problems 1–6. Write your estimates in one column. Then solve each problem and write the answer beside the estimate.

1. Ann takes care of her neighbor's baby two afternoons each week for 60¢ each afternoon.

2. Jim sells papers 6 days a week and earns about 25¢ a day.

3. Mother gives Sally 20¢ every day to help with the dishes.

4. Tom works at his father's store. He gets 25¢ each Friday afternoon and $1 on Saturdays.

5. George picks up odd jobs. He earned 50¢ one day and 75¢ another day. He thinks he will average about that much each week.

6. Ruth lives in the country. She earns 10¢ every day by feeding the chickens.

7. The more you earn each day, the (**more, less**) you earn all together.

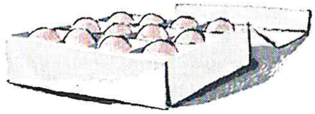
8. You have 4 presents to buy. The more money you earn, the (**more, less**) you can pay for each.

Copy and multiply:

	a	b	c	d	e	f
9.	$\begin{array}{r}473\\ \underline{68}\end{array}$	$\begin{array}{r}578\\ \underline{39}\end{array}$	$\begin{array}{r}647\\ \underline{75}\end{array}$	$\begin{array}{r}893\\ \underline{47}\end{array}$	$\begin{array}{r}493\\ \underline{59}\end{array}$	$\begin{array}{r}694\\ \underline{83}\end{array}$
10.	$\begin{array}{r}586\\ \underline{79}\end{array}$	$\begin{array}{r}497\\ \underline{96}\end{array}$	$\begin{array}{r}857\\ \underline{54}\end{array}$	$\begin{array}{r}795\\ \underline{37}\end{array}$	$\begin{array}{r}508\\ \underline{85}\end{array}$	$\begin{array}{r}685\\ \underline{46}\end{array}$

THE ANSWER STRIP

Use column **d**, page 94.



MULTIPLICATION AND DIVISION

1. How do you think of a dozen? It may be $4 \times 3 = 12$, or $3 \times 4 = 12$.

It depends on how you get started, doesn't it?

multiplicand →	3	4	4	3 ← **quotient**
multiplier →	4	3	$3\overline{)12}$	$4\overline{)12}$ ← **dividend**
product →	12	12		**divisor**

• Where the *multiplicand* and *multiplier* are the same numbers as the *divisor* and *quotient*, the *product* and the *dividend* are the same number.

2. Are the products and dividends the same in **(a)**? in **(b)**?

a. $4 \times 6 =$ **24** and $6 \times 4 =$ **24** **24** $\div 6 = 4$ and **24** $\div 4 = 6$

b. $3 \times 5 =$ **15** and $5 \times 3 =$ **15** **15** $\div 5 = 3$ and **15** $\div 3 = 5$

Since the two digits that are the multiplier and the multiplicand are the same as the two that are the divisor and the quotient, you can use multiplication to check division.

> To check division, multiply the quotient by the divisor.

A. $\begin{array}{r} 24 \\ 2\overline{)48} \end{array}$ **check:** $\begin{array}{r} 24 \\ \underline{2} \\ 48 \end{array}$

B. $\begin{array}{r} 52 \\ 3\overline{)156} \end{array}$ $\begin{array}{r} 52 \\ \underline{3} \\ 156 \end{array}$

Copy, divide, and check:

	a	b	c	d	e
3.	$3\overline{)258}$	$5\overline{)1820}$	$4\overline{)972}$	$2\overline{)1490}$	$6\overline{)2910}$
4.	$2\overline{)1812}$	$4\overline{)3900}$	$8\overline{)2056}$	$3\overline{)1380}$	$5\overline{)4010}$
5.	$9\overline{)5751}$	$7\overline{)4536}$	$6\overline{)4776}$	$8\overline{)7224}$	$9\overline{)7650}$
6.	$7\overline{)2149}$	$8\overline{)7040}$	$9\overline{)6336}$	$5\overline{)3795}$	$7\overline{)6650}$

CHECKING DIVISION WITH REMAINDERS

The Scout leader is planning a camping trip for 30 boys. Harold has divided 30 by 4 to find the number of tents the boys need. Four can sleep in each tent.

Check Harold's division. Multiply the quotient by the divisor and add the remainder. The answer should be the same as the dividend. Harold says if everyone goes, 8 tents will be needed. Is he right?

	CHECK
7	7
4)30	×4
28	28
2	2
	30

Divide and check:

	a	b	c	d
1.	2)1674	5)3965	8)3243	9)6237
2.	4)3183	7)4539	4)3440	7)5533
3.	6)4830	9)3672	9)5135	8)6883
4.	3)1780	6)5645	8)5677	7)3527

CHECKING MULTIPLICATION

Does 4×5 give the same product as 5×4?
Does $15 \times 18 = 18 \times 15$? Does $9 \times 12 = 12 \times 9$?

● The easy way to check multiplication is to change the places of the multiplier and multiplicand.

When the products are equal, the multiplication is nearly always correct.

24	16
16	24
144	64
24	32
384	384

Multiply and check:

	a	b	c	d	e
1.	15×32	47×57	79×59	48×85	86×95
2.	50×69	96×87	57×84	35×97	47×69
3.	64×97	68×64	59×86	80×90	89×47

▶ WHAT DOES AVERAGE MEAN?

The **average** is about the middle sized.

1. Harvey's dad told him to pick an average-sized pumpkin for a jack-o'-lantern. Which pumpkin should he choose?

2. Which of these girls appears to be nearest their average height?

3. Who in your room is about the average height for the class?

4. Four other rooms in your school have given \$24.88. How much must your room give to equal their average?

Tell when to *average* means to *even up*.

5. John wonders if he will be as heavy as the average weight of the boys on his team. The six boys weigh 68 lb., 70 lb., 67 lb., 73 lb., 70 lb., and 66 lb. How heavy will John have to be to equal their average?

> ▶ The average is the quotient you get when you add amounts together and divide by the number of them.

6. What is the daily average of pupils absent from Marian's school for the week shown?

What is the sum of the absences for all 5 days? Divide the sum by the number of days to find the average.

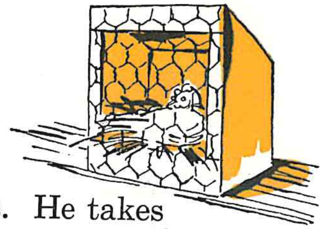
If 12 had been absent each day, how many would have been absent all week?

PUPILS	ABSENT
Mon.	13
Tues.	11
Wed.	10
Thurs.	15
Fri.	11

$$\begin{array}{r}12\\5\overline{)60}\end{array}$$

The average is 12 absent.

USING AVERAGES



1. Mr. Hansen has 4 hens that laid 19, 22, 21, and 10 eggs in a month. He uses a trap nest to tell which hens lay eggs. He takes a hen's number and marks her record. The average for all of his hens is 18 eggs per month. Which of Mr. Hansen's hens may not be earning her own living?

2. Mary says she has 7 days to read a book of 280 pages. The first day she read 60 pages. Is that as fast as the average needed to finish in 7 days?

3. Harry wants to earn $20 more to buy a bicycle for Christmas. He earned $1.50 last week. Will a weekly average of $1.50 be enough if Christmas comes in 10 weeks?

You find the average by dividing the total for all by the number of people, the units of time (as hours, days, etc.), the number of animals, or the quantity of whatever you want to average.

Daily means every day.
Weekly means every week.
Monthly means every month.
Yearly means every year.

Find the average for each below. Explain it.

4. Dick's father drove 315 miles in 9 hours.

5. Martha fed 32 quarts of chicken feed in 8 days.

6. Jack earned $22.05 in 9 weeks.

7. Ruth's practice time was 560 minutes in 7 days. Was her daily average more than $1\frac{1}{4}$ hours?

8. The school bus carries 204 children in 6 trips.

9. It took 8 gallons of gasoline to go 136 miles.

10. The football team scored 133 points in 7 games.

THE ANSWER STRIP

Use column **e**, page 94.

KNOWING AVERAGES HELPS YOU THINK

1. Bob was sleepy in school. Miss Lane found that Bob watches television, on an average, until about 9:30 each night. Other children go to bed before 8:00. Did knowing the averages help Miss Lane help Bob?

2. Mr. Hart is going to buy a car. He has read about cars and has asked several people about how many miles they can drive on a gallon of gasoline. The table shows what he found out. How does it help his thinking?

Car *A*	19
Car *B*	13
Car *C*	16
Car *D*	17

3. Mrs. Terry, the school librarian, keeps a record of books checked out.

a. What is the average for each day of the week?

b. For each week?

c. Estimate the part of the week during which the children read most.

d. Did their reading increase during the week of Halloween?

Library Books Checked Out

Week of:	M	T	W	T	F
Sept. 23	21	14	14	17	34
Sept. 30	24	15	13	16	37
Oct. 7	21	19	16	14	40
Oct. 14	23	17	19	18	43
Oct. 21	25	17	17	14	32
Oct. 28	6	8	5	5	36

4. Find the average for each group below:

a. 26, 9, 18, 17, 25

b. 36, 42, 39, 43

c. 125, 95, 116, 124

d. 42, 58, 63, 59, 48

e. \$4.75, \$8.90, \$7.35, \$7.80

f. \$1.30, \$.85, \$.90, \$.95, \$1.15

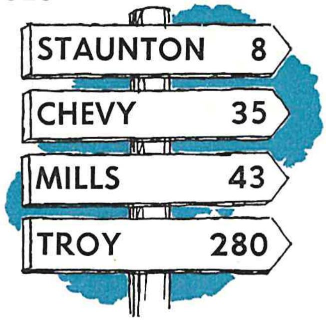
g. \$.75, \$.98, \$.69, \$.94, \$.88, \$.74

h. 20¢, 9¢, 15¢, 8¢, 13¢, 9¢, 17¢

Should a pilot fly at the average height of these peaks as he flies among them?

Black Mt.	9,950 ft.
Bald Mt.	11,005 ft.
Hagues Pk.	13,562 ft.
Longs Pk.	14,255 ft.

FINDING TOTALS WHEN YOU KNOW AVERAGES



1. Paul and Dad are starting on a trip. "About how many miles ahead should we look for a place to stay tonight?" asks Paul. "We should drive 8 hours today and average 35 miles an hour," says Dad. Can you answer Paul's question?

2. How long will it take Tony to ride his bicycle to Jim's home 4 miles away? He averages a mile in 8 minutes.

3. How many cans of dog food will be a 6-weeks' supply for Tip? He eats an average of 3 cans a week.

4. How many eggs should we buy each week? Mother says our family uses a daily average of 7 eggs. Do you think we could make 4 dozen do?

5. If you can average 8 hamburgers from a pound, will 4 lb. be enough to serve one hamburger each to 35 people?

6. If a quart of ice cream will average 6 servings, will 2 gallons serve 50 people?

7. Find the average of each of these groups of measures. Check both your addition and division.

a	b	c	d	e	f
18 in.	32 mi.	29 mi.	69 lb.	269 lb.	$6.45
14 in.	34 mi.	28 mi.	64 lb.	247 lb.	$9.63
19 in.	42 mi.	33 mi.	79 lb.	258 lb.	$7.67
17 in.	28 mi.	34 mi.	75 lb.		$8.77
			78 lb.		$6.78

Five boys tried to jump across a stream that was 5 ft. wide. Their average jump was 5 ft. What do you think happened?

CHECKING UP WITH THE ANSWER STRIP

(Adjust time to group. Do one column at a time.)

	a	b	c		d	e
(1)	4 + 6	11 − 7	9 × 9	(1)	8's in 32	6 and 7 × 5
	3 + 9	13 − 6	7 × 3		9's in 45	7 and 9 × 7
	7 + 6	18 − 9	3 × 4		6's in 42	6 and 7 × 4
	9 + 8	12 − 4	5 × 7		8's in 56	7 and 8 × 6
	8 + 5	11 − 9	6 × 3		3's in 18	5 and 7 × 7
(6)	7 + 9	13 − 7	9 × 8	(6)	8's in 72	7 and 9 × 4
	4 + 8	14 − 5	9 × 5		9's in 36	4 and 7 × 7
	6 + 7	12 − 3	7 × 4		8's in 48	3 and 6 × 8
	5 + 9	14 − 8	6 × 8		3's in 27	7 and 8 × 7
	8 + 6	16 − 9	9 × 7		4's in 16	5 and 6 × 8
(11)	7 + 5	12 − 7	4 × 6	(11)	8's in 24	6 and 9 × 4
	9 + 3	17 − 8	7 × 5		5's in 45	5 and 8 × 6
	7 + 8	13 − 9	9 × 6		7's in 42	6 and 9 × 6
	4 + 9	16 − 7	6 × 7		5's in 30	5 and 7 × 5
	5 + 7	14 − 6	8 × 8		7's in 63	8 and 9 × 7
(16)	9 + 6	15 − 8	7 × 9	(16)	4's in 36	6 and 7 × 8
	8 + 7	17 − 9	8 × 6		3's in 24	4 and 8 × 6
	9 + 5	13 − 4	4 × 7		8's in 64	8 and 9 × 4
	6 + 8	11 − 3	7 × 8		6's in 36	6 and 8 × 8
	9 + 7	15 − 9	4 × 9		4's in 28	8 and 9 × 5
(21)	5 + 8	13 − 5	8 × 5	(21)	5's in 40	6 and 7 × 7
	6 + 9	15 − 6	7 × 7		7's in 49	8 and 9 × 6
	9 + 4	14 − 9	6 × 9		6's in 54	7 and 8 × 8
	8 + 9	13 − 8	4 × 8		4's in 32	7 and 9 × 5
	4 + 7	15 − 7	7 × 6		7's in 56	8 and 9 × 8

Remember to mark your multiplication chart when you use column **c**.

PRACTICE TESTS

Set 1. Addition

1.	2.	3.	4.	5.	6.
109	8	\$ .44	\$.78	\$ 7.78	\$58.37
4	906	8.78	.55	66.87	87.89
7	87	.78	.99	97.59	8.69

Set 2. Subtraction

1.	2.	3.	4.	5.	6.
600	376	857	690	860	574
507	336	820	640	705	507

7.	8.	9.	10.	11.	12.
483	103	114	825	110	810
476	78	84	740	98	726

13.	14.	15.	16.	17.	18.
320	840	480	605	306	602
276	694	424	560	289	532

Set 3. Multiplication

1.	2.	3.	4.	5.	6.
300	430	678	201	853	479
12	20	89	43	79	97

7.	8.	9.	10.	11.	12.
467	960	982	604	891	468
68	75	40	90	76	45

Set 4. Division

1. $6\overline{)498}$ 2. $8\overline{)329}$ 3. $4\overline{)77}$ 4. $3\overline{)1896}$ 5. $9\overline{)2191}$

6. $4\overline{)704}$ 7. $7\overline{)3602}$ 8. $9\overline{)2716}$ 9. $8\overline{)904}$ 10. $5\overline{)768}$

11. $3\overline{)708}$ 12. $9\overline{)4801}$ 13. $7\overline{)764}$ 14. $5\overline{)1038}$ 15. $6\overline{)2783}$

UNIT 7

PROBLEM SOLVING

A BIG PROBLEM FOR A CLASS—MAKING A PICTURE OF PIONEER LIFE

Their Smaller Problems

Shall they use crayon or paint? How much will they need?

What kind of paper shall they use?

How shall they fasten the paper?

1. Can you think of more problems about the paper? How long will it take to make the picture? Shall they draw a sketch first?

2. What other problems do you think of about the drawing? How many committees are needed?

3. This job will need good thinkers, good planners, and good workers. Do you think of other problems the children will need to think about as they solve their big problem?

WHAT IS THE QUESTION?

1. Jane says the first problem is to find out how much wrapping paper is needed to make a wall picture of Booneville. The space to cover is 6 yd. long. It will take two strips of paper to cover the space.

What is the question that must be answered? Choose the best one from these:

a. How many strips will be needed? **b.** How many yards. **c.** How many yards must be unrolled all together?

2. Seven committees are planned for the different jobs. How large will the committees be if they are about the same size? There are 28 pupils to be put on committees.

What question asks what the class really wants to know? To answer the question do you add, divide, subtract, or multiply?

3. The average number of children on each committee is 4, but not all committees have 4 members. There are 4 on the planning committee, 5 on the food committee, 3 for clothing, 6 for shelter, and 3 for music. So far 21 children have chosen their committees. How many of the 28 children are left for the other two committees?

Read the problem above carefully. What is the question? Tell us what the problem says. How do you solve it?

4. Making the mural will take 5 weeks. Which of these dates will be closest for finishing the mural? The planning committee says it will be started right away after Halloween. What is the question?

Oct. 31 Nov. 5 Nov. 20 Dec. 7 Jan. 1

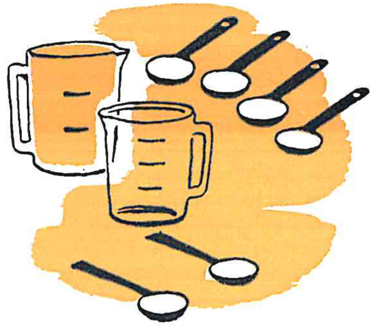
5. Will a dime apiece from 28 pupils pay for a party that costs $2.75? Ask another question about the cost.

PROBLEMS ABOUT THE BOONEVILLE PICTURE

1. The picture will be 6 yards long. The children plan to divide it into 3 parts. The center part will be half the length of the picture. How long will it be?

2. The recipe for paint is:

1 cup paint powder
1 cup water
4 tablespoons paste
2 tablespoons liquid starch



Mix $\frac{1}{4}$ cup water with paint powder. Stir until smooth. Add paste, starch, and remaining water. Stir well after each addition. Thin with water.

Write a double recipe; a triple recipe.

PRACTICE

Add:

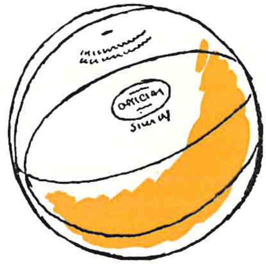
	a	b	c	d	e	f
1.	\$5.60	\$ .28	\$4.44	\$4.67	\$6.38	\$5.79
	2.46	2.73	5.99	6.99	7.86	2.67
	5.04	.86	.05	6.87	9.08	8.83
	8.00	6.33	.65	4.97	.78	5.45

Multiply:

2.	462	503	935	643	350	264
	35	42	60	97	85	64
3.	795	589	847	586	769	879
	73	94	89	70	28	56

Divide:

4.	$7\overline{)93}$	$2\overline{)847}$	$4\overline{)956}$	$8\overline{)595}$	$6\overline{)4097}$	$3\overline{)809}$
5.	$8\overline{)4003}$	$5\overline{)3745}$	$7\overline{)2809}$	$9\overline{)810}$	$4\overline{)900}$	$3\overline{)706}$



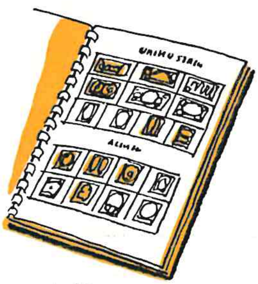
PROBLEMS WITHOUT NUMBERS

1. Suppose you know how much money a basketball costs and how much money you have. How much more will you need to buy the basketball?

ANSWER: *Find the difference between your money and the cost of the basketball. If you have less, you need the difference.*

2. You know how many fish each boy caught. How many did all the boys catch? Tell how you would find the answer.

3. How many children are in your class today? You know the number absent and the number who are members of the class.



4. You know how many pages of stamps someone has. Each page has the same number. How many stamps has he all together?

5. You know how much a football costs. You know how many are going to share its cost equally. How will you find each one's equal share?

6. You know how tall you are now and how tall you were this time last year. How much have you grown?

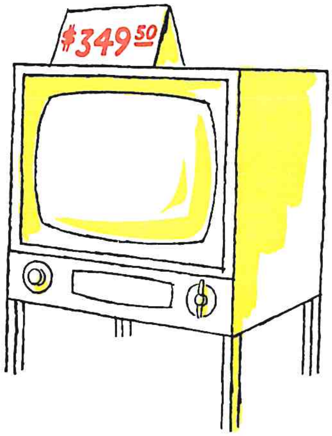
7. You know how many bars of candy you are buying and what each bar costs. How do you find the total cost?

8. You buy 6 pencils at one price and 2 erasers at another price. How do you find the cost of all of them?

9. You know what the meat you are buying costs and what the fruit is costing. How can you tell the amount of change to get from a ten dollar bill?

You know how many stamps Jim has and how many Bob has. Bob has how many times as many as Jim?

BUYING A TELEVISION SET



Label the answer for each problem below:

1. Jack wants a television set. It costs $349.50. Mother and Dad have only $150 to spend for it. How much more money will be needed to pay for it? Label the answer this way:

$____ *will be needed to pay for the TV.*

2. Whenever an amount is close to $200, or $100, and so on, we often say about $200, or about $100.

a. $199.50 is about how many dollars?

b. $149.50 is about how many dollars?

3. How can Jack's family get $200? Jack says he can earn $2 a week. How many weeks would it take him to earn $200? That is about how many years?

4. Mother says, "I have a job. We'll buy our television." Mother's job is working at the bakery four half days a week. She earns $1.25 an hour for 4 hours. (A regular working day is usually 8 hours.) What are her wages for a half day?

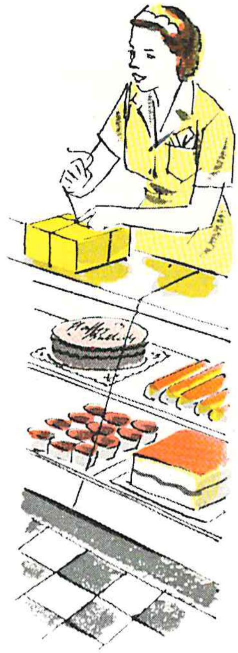
5. How many half days does it take to earn $200 if you earn $5 in one half day?

6. How many weeks does it take to work 40 half days if you work 4 half days each week?

7. Jack's mother earns $5 in one half day. She works 4 half days each week. How much does she earn in a week? Will the answer be days, weeks, or dollars?

8. If Jack's mother earns $20 a week, how much can she earn in 10 weeks?

PROBLEMS IN THE BAKERY



For each sale, decide whether to add, subtract, divide, or multiply. Then find the answer.

1. "We have delicious cream puffs today at 8¢ each." "Give me 12, please."

2. "May I have half of that \$1.50 cake?" "Yes, you may, at just half the whole price."

3. "Your bread is 22¢, the pie is 60¢, and the rolls are \$1.20."

4. "A dollar nineteen out of five dollars."

5. "How much are 8 dozen weiner rolls?" "They are 48¢ a dozen. That would be _?_."

6. "The large cake is \$1.15 and the smaller one is 89¢. I had better buy the smaller one and save the _?_¢."

PRACTICE

1. \$ .36 .49 .17	**2.** \$ 5.00 −2.36	**3.** 2)\$1.48	**4.** \$ .48 ×7	**5.** \$ 1.12 −.85
6. \$ .68 .14 1.15	**7.** \$ 1.00 −.39	**8.** \$ 1.79 +1.48	**9.** 15 ×12	**10.** \$ 2.00 −1.13
11. \$ .39 ×7	**12.** \$ 1.50 −1.17	**13.** \$ 2.95 ×9	**14.** \$1.36 2.48 .19	**15.** \$ .90 −.49
16. \$ .26 ×48	**17.** \$ .37 1.19 .67	**18.** 9)\$4.68	**19.** 3)\$4.05	**20.** 2)\$4.10
21. \$ .25 ×20	**22.** \$ .87 +.96	**23.** 2)\$9.60	**24.** 3)\$2.70	**25.** \$10.08 −7.43

PROBLEMS WITH TWO QUESTIONS

How Much Change?

Mother, Bert, and Donna go to town Saturday morning to shop.

1. Bert takes a dollar of his money. He buys an airplane cutout for 49¢ and a bicycle pant clip for 18¢. How much money will he have to take home?

What is the question in the problem? What other question must you answer first?

Read carefully to find the questions.

The problem question: →	1. How much is left from the dollar?
A question you cannot see: →	2. How much do the cutout and clip cost together?

Facts: **a.** He took $1. **b.** He spent 49¢ and 18¢.	Two examples to do:	49¢ 18¢ 67¢	$1.00 −.67 $ .33

In the problems below, write the problem question and the question you cannot see. Then solve.

2. Mother gives the clerk $5 for a cowboy belt priced at $1.45 and Western dungarees at $2.69.

What should her change be? Write the questions.

Suggestion: Find total cost of belt and dungarees.

3. Donna's anklets cost 39¢. How much change will there be from a dollar if Mother buys 2 pairs? What is the question you cannot see?

4. Groceries cost $4.68 and meat costs $2.76. What is left from a ten-dollar bill?

5. On the way home Mother gives two quarters for 3 ten-cent ice-cream cones. What should be the change?

ESTIMATING AS YOU SHOP

"What can I buy with a dollar?" Bert asked himself as he walked along the counters.

1. Can he buy two pants clips at 18¢ each and a horn for 52¢?

2. Can he buy 3 comic books at 20¢ each and 1 at 25¢?

3. Can he buy a box of 10 puzzles for 69¢ a box and 6 colored pencils at 5¢ each?

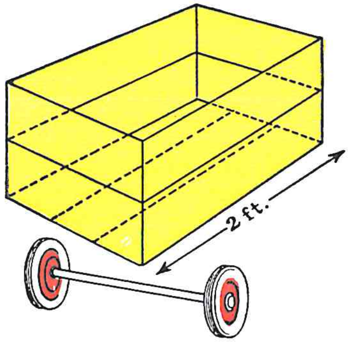
4. Can he buy a mechanical pencil at 69¢, a box of leads at 15¢, and a notebook at 30¢?

5. Can he buy 3 hamburgers at 23¢ each and 3 milkshakes at 21¢ each?

6. Make a table like the one below. See what is spent and paid. List the change. **a** is done for you.

Amount Spent	Bills or Coins Paid	Change to be Returned
a. \$2.00, 60¢, \$4.25	\$10	5¢, 10¢, \$3
b. 69¢, 75¢, \$1.50	\$3	
c. 4 at \$1.29 each, and \$2.77	\$10	
d. \$3.64, and 2 at 42¢ each	\$5	
e. 3 at 17¢ each and 1 at 18¢	50¢, 25¢	
f. 2 at 29¢ each and 1 at 36¢	50¢, 50¢	
g. \$4.95, \$4.98, and 15¢	\$5, \$5, 10¢	
h. 2 at 75¢ each and 1 at \$1.70	\$3, two dimes	
i. 12 at 70¢ a doz. and 1 for 35¢	\$1, a quarter	

Where can you get information you need to answer the last six questions on page 105?



▶ ESTIMATING AND MEASURING

Dick has drawn a picture of a trailer for his bicycle. How many boards does he need? How long must they be?

The boards are to be 6 in. wide. The trailer is to be 3 boards wide, 2 boards high, and 2 ft. long.

1. Can Dick make the trailer box from 1 board which is 6 in. wide and 14 ft. long? 16 ft. long?

2. Can Dick make the trailer box from a board 8 ft. long and another 10 ft. long?

3. Will he waste lumber if he buys 2 boards each 12 ft. long?

4. Dick's dad says he can't see how Dick's top boards on the sides will be nailed to the bottom boards. He says the sides and ends should be 12 in. wide. How long would a board 12 in. wide need to be to make both the ends and the sides?

5. Boards usually come in lengths of feet that are even numbers. Is 7 ft. odd or even?

6. Dick worked a long time to find a way that wouldn't make him pay for lumber he wouldn't use. Finally he said, "I'll make the sides with 12-in. boards and the rest with 6-in. boards." How long will the 12-in. board be? the 6-in. board? Are the lengths odd or even?

Draw pictures to help work these:

7. 4 yd. = _?_ in.	**13.** 6 in. = _?_ ft.
8. 6 yd. = _?_ ft.	**14.** $2\frac{1}{2}$ ft. = _?_ in.
9. 5 ft. = _?_ in.	**15.** 3 ft. 4 in. = _?_ in.
10. 120 in. = _?_ ft.	**16.** 6 yd. 2 ft. = _?_ ft.
11. 3 × 24 in. = _?_ ft.	**17.** 5 ft. 3 in. = _?_ in.
12. 45 ft. = _?_ yd.	**18.** 36 in. = _?_ ft.

ARE MORE FACTS NEEDED?

Marilyn and Carolyn, the twins in our class, wondered if they could shoot arrows as well as the Indians did. They asked their mother for an archery set. Read their problems below and see if all the needed facts are there:

1. An archery set costs $4.98. How much change will there be? How will they work the problem when they have all the facts?

2. "You'll need a target," said Mother. "We'll buy it and the set with this ten-dollar bill." Now what will their change be? The answer depends on what? How will they work the problem if they know all the facts?

3. Extra arrows cost 28¢ each. What will be the total cost of an archery set for $4.98 and extra arrows? The answer depends on what? Tell how to work the problem if enough facts are known.

4. The girls will first place the target at 10 yd. How many feet is that? Do you have enough facts?

PRACTICE IN FINDING FACTS FOR PROBLEMS

1. What is the population of your town or nearest town?

2. What is the distance from your town to Chicago?

3. What is the price of gasoline a gallon?

4. What is the cost of a loaf of bread? a quart of milk?

5. How much does your school pay for pencils? paper? balls and bats? erasers? chalk? rulers? books?

6. How many people live in the United States of America? Mexico? Canada? England? China? India? Brazil?

A TEST IN PROBLEM SOLVING

1. How many people lived in three Pacific Coast states in 1950? The census showed these populations:

Washington 2,378,963 Oregon 1,521,341
California 10,586,223

2. If 9 baseball suits for a team cost $75.15, what is the average cost?

3. How much will a year's rent be at $77.50 a month?

4. How many pints of milk can be poured from a $2\frac{1}{2}$-gal. can?

5. How far will the Grays go if they average 325 mi. daily for 5 days?

6. Eight turkeys weigh 128 lb. What is the average weight?

7. How long has Joe been gone? He left at 8:45 A.M. It is now 2:15 P.M.

PRACTICE

Multiply:

1. $\begin{array}{r} 368 \\ \underline{6} \end{array}$ **2.** $\begin{array}{r} 468 \\ \underline{9} \end{array}$ **3.** $\begin{array}{r} 586 \\ \underline{7} \end{array}$ **4.** $\begin{array}{r} 978 \\ \underline{35} \end{array}$ **5.** $\begin{array}{r} 679 \\ \underline{28} \end{array}$

Subtract:

6. $\begin{array}{r} 830 \\ \underline{759} \end{array}$ **7.** $\begin{array}{r} 1103 \\ \underline{895} \end{array}$ **8.** $\begin{array}{r} 605 \\ \underline{548} \end{array}$ **9.** $\begin{array}{r} 613 \\ \underline{604} \end{array}$ **10.** $\begin{array}{r} \$10.12 \\ \underline{8.45} \end{array}$

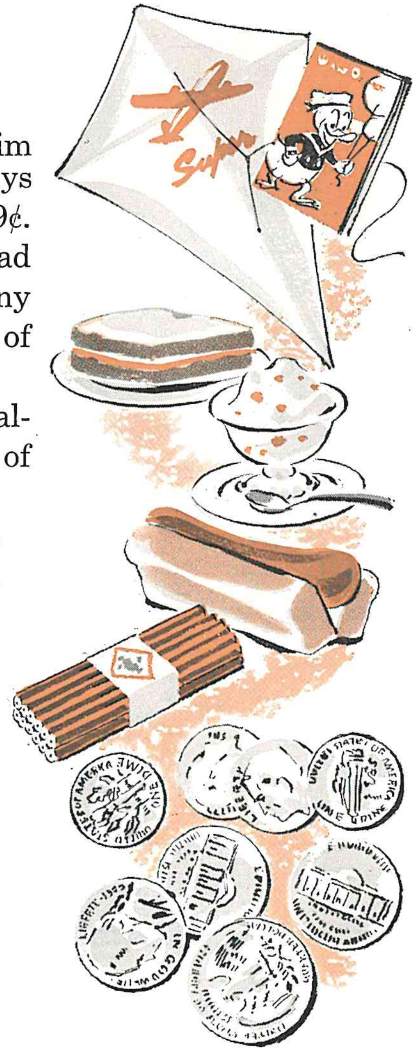
Add:

11. $\begin{array}{r} 427 \\ 563 \\ 736 \\ \underline{382} \end{array}$ **12.** $\begin{array}{r} \$8.75 \\ 5.00 \\ .89 \\ \underline{6.47} \end{array}$ **13.** $\begin{array}{r} \$7.38 \\ 4.76 \\ .60 \\ \underline{4.58} \end{array}$ **14.** $\begin{array}{r} \$6.70 \\ .77 \\ 9.09 \\ \underline{5.98} \end{array}$ **15.** $\begin{array}{r} 98 \\ 577 \\ 8 \\ \underline{867} \end{array}$

Divide:

16. $7\overline{)3479}$ **17.** $8\overline{)6723}$ **18.** $6\overline{)2987}$ **19.** $4\overline{)3215}$

A TEST IN PROBLEM SOLVING



1. How much money will Jim have left? He has \$1.00. He buys a comic book for 20¢ and a kite for 49¢.

2. Mother uses two slices of bread to make two sandwiches. How many sandwiches can she make from a loaf of 20 slices?

3. How many children will 2 gallons of ice cream serve? One quart of it will serve 6 children.

4. How many children can be served 2 weiners each? Five dozen weiners were bought for the picnic.

5. How much will 12 dozen pencils cost at 5¢ each?

6. A room is 24 ft. wide and 30 ft. long. How many yards is it all the way around the room?

7. How many cents does Nancy have? She has 4 dimes, 3 nickels, and 1 quarter.

GROWTH TEST

1. 9×80

2. $153 - 68$

3. 5×962

4. $4085 \div 6$

5. $\frac{1}{5}$ of 350

6. $651 \div 7$

7. $3859 + 9775$

8. $8 + 768$

9. 4×4079

10. $340 - 294$

11. 37×278

12. $4106 \div 7$

13. $4859 \div 8$

14. $9286 - 5329$

15. $8 + 3 + 5 + 6$

16. $3001 \div 4$

17. 90×470

18. $1910 - 1327$

19. $68 + 557 + 200 + 79$

20. $240 + 36 + 49 + 698$

UNIT 8

MEANING OF FRACTIONS

FRACTIONS ARE PARTS

Four children share a picnic lunch. Can you tell what each one's equal share of the food in the picture will be?

1. Should each one have one *half* or one *fourth*? Why?

2. How many halves of apples do you see? How many whole apples is that?

3. How many bananas are divided among the four children? How much does each one get?

4. What will each one's share of the milk be?

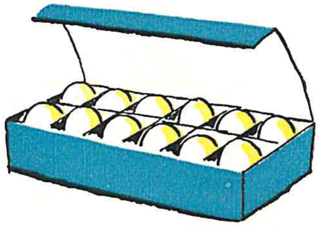
5. What part of the melon will be an equal share?

6. If there were two children, what fraction would be each one's equal share?

7. When two children share a melon equally, will each have more or less than if four children had equal shares of the same melon?

8. When we say that a half is 1 of 2 equal parts of a thing, do we mean *exactly* equal?

ARE THE PARTS EXACTLY EQUAL?

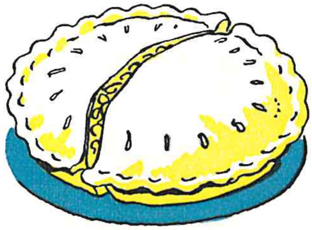


1. How many eggs are a half dozen? Do you think that 6 eggs will weigh exactly the same as 6 other eggs?

When you count the eggs, 6 is exactly equal to 6.

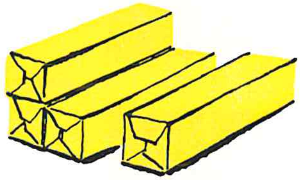
When you weigh them, the weights are not exactly equal.

When you think of a half of a *number*, the halves are equal.



When you think of half an *apple* or half a *pie*, the halves are as nearly equal as you can get them.

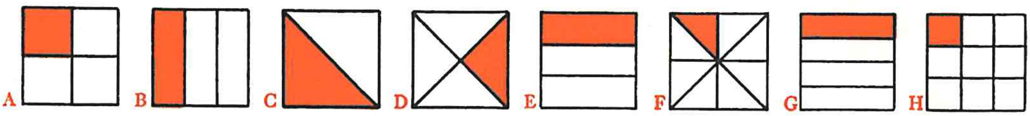
2. When you were little, did you ever want the "big half"? If one half is larger than another, is it really a half? We call something a half if it is as close to a half as we can get it.



3. What thing in the pictures at the right is divided into *fourths*? into *halves*? into *thirds*?

4. How many *thirds* are there in a whole thing? fifths? eighths? fourths?

5. Name the colored parts in each of these squares:



6. Read these fractions: $\frac{1}{4}$ $\frac{1}{5}$ $\frac{1}{2}$ $\frac{1}{6}$ $\frac{1}{8}$

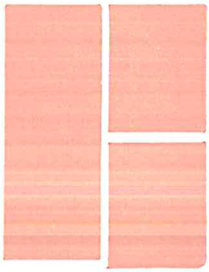
7. Use digits to write *one third*; *one fifth*; *one half*; *one fourth*; *one eighth*; *one sixth*.

Do one set on page 114 today, and one on each of the next two days.

THE SIZE OF PARTS

A

B



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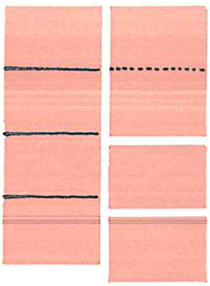


1. Fold a piece of paper in the middle and cut it into two pieces.

Fold one *half* again and cut it into two equal parts. Now you have three pieces. What are their sizes?

2. Lay the two *fourths* on the half. Do they match? Do *two fourths* equal one *half*?

Another way to write two fourths is $\frac{2}{4}$.

3. Fold one of the fourths and make two equal pieces from it. How many of these new small pieces can you make from the whole sheet?

What is the size of one of the small pieces?

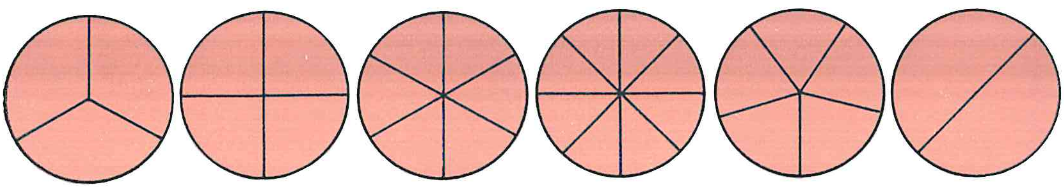
4. How many *eighths* did you make from a *fourth*?

5. A whole sheet of paper has how many halves? fourths? eighths?

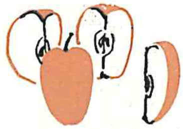
6. Which is larger, $\frac{1}{2}$ or $\frac{1}{4}$ of a thing? $\frac{1}{2}$ or $\frac{1}{8}$? $\frac{1}{4}$ or $\frac{1}{8}$?

7. Is it the number above or below the line in a fraction that tells how large the part is?

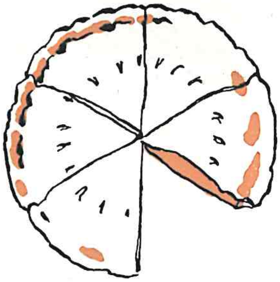
8. Write a fraction that will tell the size of one part in each circle below:



D E F G H I



THE NUMERATOR AND DENOMINATOR



1. Into how many pieces is the apple divided? Each piece is $\frac{1}{4}$ of an apple. Two pieces are $\frac{2}{4}$. Three pieces are $\frac{3}{4}$. A whole apple is $\frac{4}{4}$ after it is cut into 4 pieces.

2. How can 1 apple become $\frac{3}{3}$? $\frac{5}{5}$? $\frac{2}{2}$?

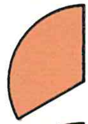
3. Tom's mother baked this pie. She cut it into how many sixths? $\frac{1}{6}$ has been eaten. There are $\frac{?}{6}$ left.

The fractions you have been thinking about have two numbers.

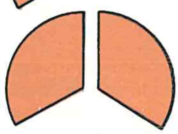
$\frac{1}{4}$ numerator / denominator

- The number above the line is called the **numerator.**
- The number below the line is called the **denominator.**

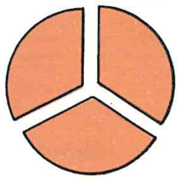
4. Which number in a fraction tells the size of the parts?

$\frac{1}{3}$ 

Is the size of the parts the same in each of these groups?

$\frac{2}{3}$ 

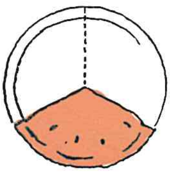
The first is 1 part. The middle group has 2 parts. The third group has 3 parts.

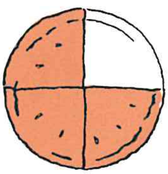
$\frac{3}{3}$ 

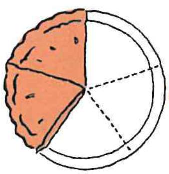
Does the numerator or the denominator tell the size of the parts?

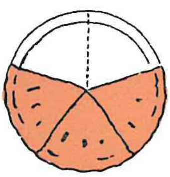
> The numerator tells the number of parts.
> The denominator tells the size of each part.

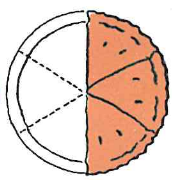
5. Read each of these fractions of a pie:

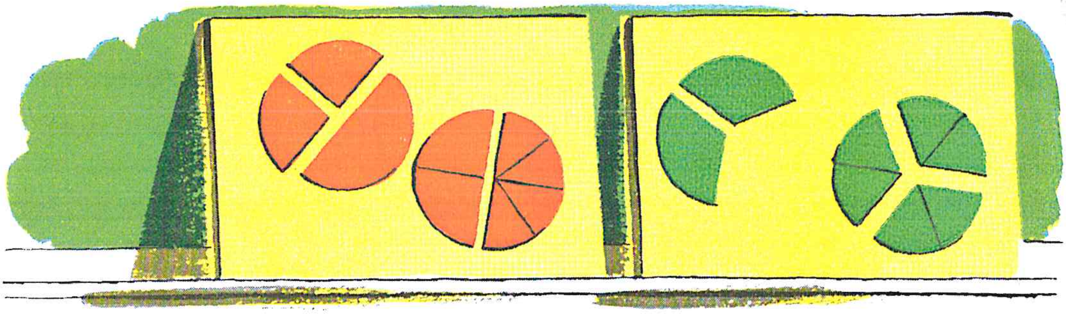

$\frac{1}{3}$


$\frac{3}{4}$


$\frac{2}{5}$


$\frac{3}{5}$


$\frac{3}{6}$



HALVES, FOURTHS, AND EIGHTHS

Mrs. Brown made a flannel board. She cut circles of felt into halves, thirds, fourths, sixths, and eighths. The children had fun matching the pieces to learn the sizes. Some children made small flannel boards of their own. Others cut circles from colored paper.

1. How many fourths match a half?
2. How many halves match a whole?
3. How many eighths match a fourth?
4. How many eighths match a half?
5. One fourth and how many eighths match a half?
6. Are three eighths more than one fourth? less than one half?
7. Are five eighths more or less than one half?
8. How many eighths match two fourths?

The answer to each question above is given below.

Read each question again. Then read its answer below each time:

1. $\frac{2}{4} = \frac{1}{2}$ **3.** $\frac{2}{8} = \frac{1}{4}$ **5.** $\frac{1}{4} + \frac{2}{8} = \frac{1}{2}$ **7.** More

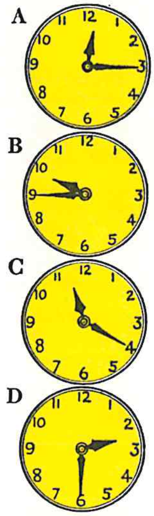
2. $\frac{1}{2} + \frac{1}{2} = 1$ **4.** $\frac{4}{8} = \frac{1}{2}$ **6.** Yes. Yes. **8.** $\frac{4}{8} = \frac{2}{4}$

9. Write these fractions with the answers:

a. $1 = \frac{?}{4}$ **c.** $\frac{1}{2} = \frac{?}{4}$ **e.** $\frac{1}{4} + \frac{1}{4} = \frac{?}{2}$ **g.** $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{?}{4}$

b. $\frac{1}{4} = \frac{?}{8}$ **d.** $\frac{2}{4} = \frac{?}{8}$ **f.** $\frac{1}{8} + \frac{1}{8} = \frac{?}{4}$ **h.** $\frac{1}{8} + \frac{1}{8} + \frac{1}{8} = \frac{?}{8}$

FRACTIONAL UNITS OF MEASURE



1. What does the fraction mean when you say it is half past two? a quarter to three? a quarter after one? Is a quarter one fourth? These are fractions of what?

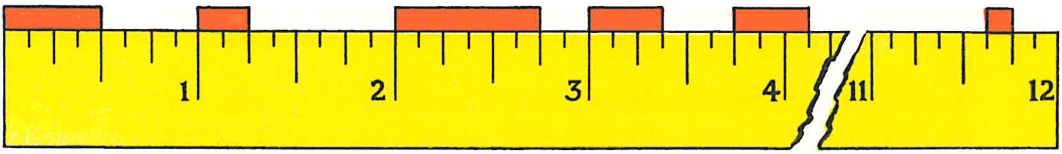
2. Which clock is a quarter to ten? a quarter after twelve? eleven twenty?

3. What time is clock *D*?

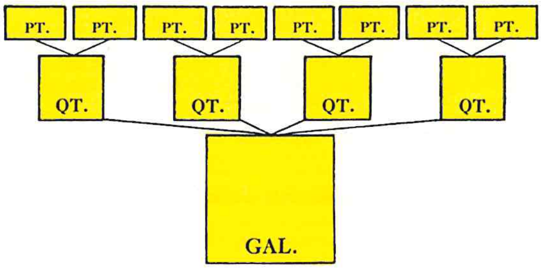
Did you say *half past two* or 2:30?

If the clock read 2:32, you might say it was 2:30. Time is often rounded.

4. The two ends of a ruler are shown measuring six blocks. What fraction of an inch long is each block?



5. Count the half inches in 1, 2, 3, and 4 inches. Count the quarter inches in 1 and 2 inches. How many eighths in 1 in.? in $\frac{1}{8}$ in.? in 2 in.?



6. A quart is $\frac{?}{4}$ gal.

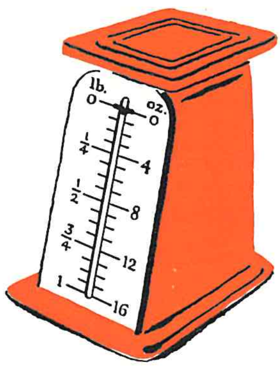
7. A pint is $\frac{?}{2}$ qt.

8. A pint is $\frac{?}{8}$ gal.

9. $\frac{1}{2}$ gal. is $\underline{\ ?\ }$ pints.

10. $\frac{3}{4}$ gal. is $\underline{\ ?\ }$ quarts.

11. $\frac{4}{4}$ gal. is $\underline{\ ?\ }$ quarts.



12. 1 lb. $= \underline{\ ?\ }$ oz.

13. $\frac{1}{4}$ lb. $= \underline{\ ?\ }$ oz.

14. $\frac{1}{2}$ lb. $= \underline{\ ?\ }$ oz.

15. 8 oz. $= \underline{\ ?\ }$ lb.

16. $\frac{4}{16} = \frac{?}{4}$

17. $\frac{8}{16} = \frac{?}{2}$

18. $1 = \frac{?}{16}$

19. $\frac{2}{4} = \frac{?}{16}$

PRACTICE

Set 1. Use an answer sheet:

a. $\begin{array}{r} 355 \\ 897 \\ 577 \\ \underline{973} \end{array}$

b. $\begin{array}{r} 953 \\ \underline{-794} \end{array}$

c. $7\overline{)476}$

d. $\begin{array}{r} 635 \\ \underline{\times 8} \end{array}$

e. $\begin{array}{r} 1425 \\ \underline{-738} \end{array}$

f. $4\overline{)388}$

g. $6\overline{)228}$

h. $\begin{array}{r} 46 \\ 478 \\ 929 \\ \underline{694} \end{array}$

i. $8\overline{)672}$

j. $\begin{array}{r} 968 \\ \underline{\times 3} \end{array}$

k. $\begin{array}{r} 1546 \\ \underline{-689} \end{array}$

l. $\begin{array}{r} 869 \\ \underline{\times 7} \end{array}$

m. $\begin{array}{r} 7508 \\ 6327 \\ \underline{7789} \end{array}$

n. $\begin{array}{r} 697 \\ \underline{\times 4} \end{array}$

o. $\begin{array}{r} 115 \\ \underline{-88} \end{array}$

p. $5\overline{)345}$

q. $9\overline{)666}$

Set 2. Use an answer sheet:

a. Find the difference between 931 and 237.
b. What is the sum of 67 + 958 + 7?
c. How many are 97 multiplied by 68?
d. How many sevens are there in 525?
e. Take 796 from 1375.
f. How many are 40 times 480?
g. How many are 79 + 208 + 665 + 90?
h. What is 612 divided by 9?
i. $768 \div 8 =$
j. $7 \times 749 =$
k. $669 + 374 =$
l. $1563 - 875 =$
m. $516 \div 6 =$
n. $1201 - 849 =$
o. $853 + 559 =$
p. $90 \times 305 =$

Set 3. Use an answer sheet. Multiply **a** through **j.**

a. $\begin{array}{r} 396 \\ \underline{8} \end{array}$ **b.** $\begin{array}{r} 869 \\ \underline{5} \end{array}$ **c.** $\begin{array}{r} 583 \\ \underline{7} \end{array}$ **d.** $\begin{array}{r} 397 \\ \underline{9} \end{array}$ **e.** $\begin{array}{r} 769 \\ \underline{3} \end{array}$

f. $\begin{array}{r} 897 \\ \underline{6} \end{array}$ **g.** $\begin{array}{r} 785 \\ \underline{8} \end{array}$ **h.** $\begin{array}{r} 709 \\ \underline{4} \end{array}$ **i.** $\begin{array}{r} 469 \\ \underline{7} \end{array}$ **j.** $\begin{array}{r} 648 \\ \underline{9} \end{array}$

k. $6\overline{)576}$ **l.** $8\overline{)544}$ **m.** $9\overline{)414}$ **n.** $3\overline{)255}$ **o.** $5\overline{)290}$

p. $7\overline{)602}$ **q.** $4\overline{)316}$ **r.** $9\overline{)702}$ **s.** $6\overline{)384}$ **t.** $8\overline{)600}$

FRACTIONS OF A GROUP

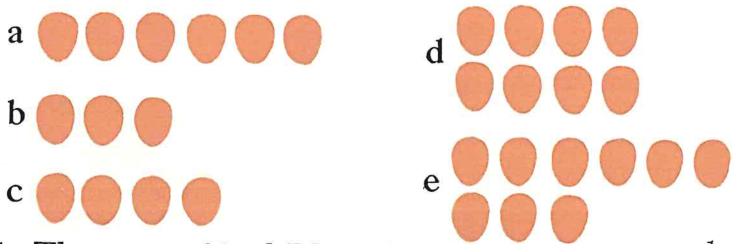
Have you heard these expressions or descriptions?

A third of the class
A half dozen
Half the time
A fourth of a yard
Half of the people
A small portion of them

1. "I need another half dozen eggs," said Bob's mother while she was shopping. What is $\frac{1}{2}$ of 12?

2. How many is $\frac{1}{3}$ dozen? $\frac{1}{4}$ dozen?

3. Which group below is $\frac{1}{4}$ dozen? $\frac{1}{3}$ dozen? $\frac{3}{4}$ dozen? $\frac{2}{4}$ dozen? $\frac{2}{3}$ dozen?



4. There are 30 children in the class. About $\frac{1}{3}$ are working on a map. How many is $\frac{1}{3}$ of 30?

5. If exactly half of the 30 children are girls, how many boys are there in the class?

6. A quarter yard of ribbon is how many inches?

7. "In half the time" is how long if the whole time is 40 minutes?

8. Martha says, "I'll write a third of the invitations." What is $\frac{1}{3}$ of 36 invitations?

9. At least a fourth of the 32 children in Joe's room have read a good book this week. How many is $\frac{1}{4}$ of 32?

10. How many is $\frac{1}{3}$ of 12? $\frac{1}{5}$ of 15? $\frac{1}{6}$ of 12? $\frac{1}{4}$ of 16?

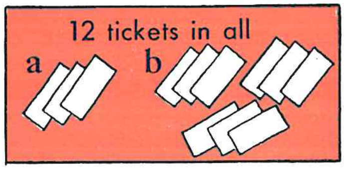
• To find the number in one equal part of a group, divide the number in the group by the denominator of the part.

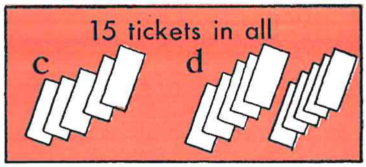
FINDING MORE THAN ONE PART OF A GROUP

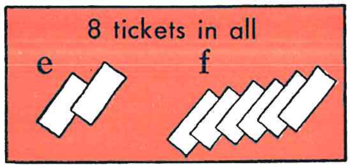
1. Miss Barton says two thirds of a class of 33 children walk to school each day. How many is $\frac{2}{3}$ of 33? $\frac{1}{3}$ of 33 is how many? Will $\frac{2}{3}$ be twice as many as $\frac{1}{3}$? $33 \div 3 = 11$; $2 \times 11 = 22$. So two thirds of 33 are 22.

2. A good way to learn fractions of groups is to use cardboard tickets about 1 in. by 3 in.

What parts are (**a**) and (**b**) of 12? (**c**) and (**d**) of 15? (**e**) and (**f**) of 8?







3. Our school has about 450 fathers. Mrs. Grant says at least $\frac{2}{3}$ of them will come to the fathers' night program. How many is $\frac{2}{3}$ of 450?

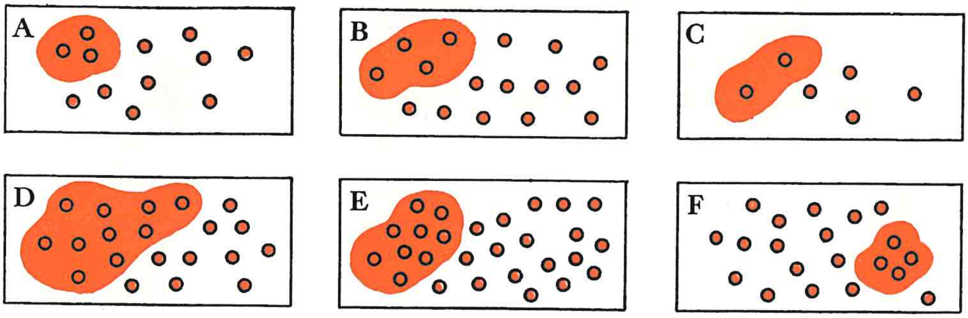
$$\begin{array}{r} 150 \\ 3\overline{)450} \\ 3 \\ \hline 15 \\ 15 \\ \hline 0 \end{array}$$

First you find $\frac{1}{3}$. One third is 150.
Then you find $\frac{2}{3}$. → $\begin{array}{r} 150 \\ \times 2 \\ \hline 300 \end{array}$
$\frac{2}{3}$ of 450 is → 300

● When you want to find more than one part of a group, as $\frac{3}{4}$ of it, you divide by the denominator to find the size of one part, and multiply by the numerator to get the number for all the parts.

4. Find these parts of groups:

a. $\frac{2}{3}$ of 24	**e.** $\frac{3}{8}$ of 48	**i.** $\frac{2}{5}$ of 500	**m.** $\frac{2}{3}$ of 36
b. $\frac{3}{4}$ of 16	**f.** $\frac{2}{8}$ of 40	**j.** $\frac{3}{4}$ of 60	**n.** $\frac{3}{5}$ of 100
c. $\frac{2}{4}$ of 48	**g.** $\frac{3}{5}$ of 25	**k.** $\frac{2}{3}$ of 144	**o.** $\frac{3}{4}$ of 36
d. $\frac{2}{5}$ of 40	**h.** $\frac{1}{4}$ of 144	**l.** $\frac{4}{5}$ of 100	**p.** $\frac{5}{6}$ of 12



ESTIMATING SIZES OF PARTS

1. Look at each of the groups above. A part of each group is on colored background. Estimate the size of the part on color, as $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$ of the group, and so on.

2. See how nearly right your estimates were. Rectangle *A* has 12 dots in it. Three of them are on color. What part of 12 is 3?

> Jim says you can make a drawing to find out.
> Ann says $12 \div 3$ is 4. 3 is $\frac{1}{4}$ of 12.
> Jerry says you can make a fraction to compare two numbers, such as 3 parts of 12 things. $\frac{3}{12} = \frac{1}{4}$

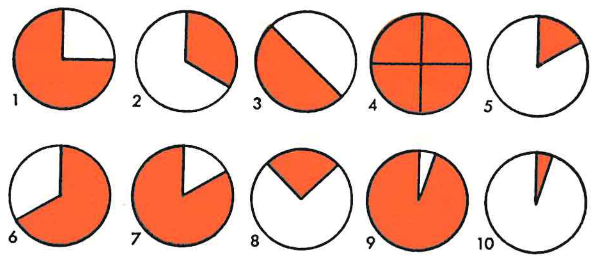
3. Work *B* and *C* by Jerry's way.

4. Work *D*, *E*, and *F* by Ann's way.

5. Cut paper pie plates or circles into fractional parts. Then estimate their sizes as $\frac{1}{3}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{2}{5}$, $\frac{1}{6}$, $\frac{5}{6}$, $\frac{4}{5}$.

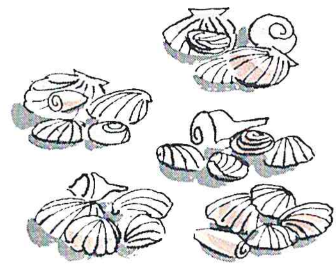
6. Match each colored part with a letter at the left:

a. $\frac{2}{3}$ **f.** $\frac{4}{4}$
b. $\frac{1}{6}$ **g.** $\frac{15}{16}$
c. $\frac{1}{4}$ **h.** $\frac{3}{4}$
d. $\frac{1}{3}$ **i.** $\frac{5}{6}$
e. $\frac{1}{2}$ **j.** $\frac{1}{16}$



7. List 4 pairs in Problem 6 which would make a whole colored circle, as $\frac{15}{16} + \frac{1}{16}$.

▶ EQUAL SHARES



1. Mrs. Stone took 5 children to the beach. They hunted seashells to take home. The children shared the shells equally. What fraction was each one's share?

2. They found 25 good shells. How many shells were each one's equal share?

3. They had hoped to find enough shells to share with all 30 children in their class. What is each equal share of something if 30 children share it?

4. If each share for 5 children is $\frac{1}{5}$, how many fifths are 5 shares all together?

Write these problems as fractions and work them:

5. How many is each equal share

$$\frac{1}{3} \text{ of } 42 = \begin{array}{r} 14 \\ 3\overline{)42} \\ \underline{3} \\ 12 \\ \underline{12} \end{array}$$

- **a.** when 3 children share 42 nuts?
- **b.** when 8 children share 48 crayons?
- **c.** when 5 children share 45 bottle tops?
- **d.** when 6 children share 78 marbles?
- **e.** when 4 children share 16 balloons?

6. Three boys and Tom want his smaller brother to share acorns equally with them. Tom takes home his own share and his brother's. What part of all does Tom take?

7. What part is 2 shares when 3 boys share equally?

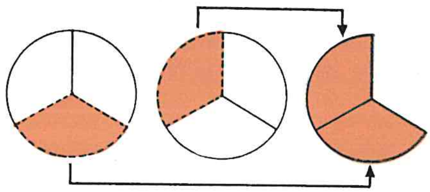
8. What part is 3 shares when 6 boys share equally?

EQUAL PARTS OF TWO THINGS

1. How would you divide two apples into three equal parts? Jack's idea is to share each apple at a time. Does that give you an idea?

Take 2 paper circles. Mark them in thirds. Cut $\frac{1}{3}$ out of each circle.

Put the one third and one third together. What do you have?



$\frac{1}{3}$ of 2 is $\frac{2}{3}$. Does $2 \div 3 = \frac{2}{3}$?

- *A fraction is a way of writing division.*

$\frac{2}{3}$ means 2 divided by 3.

$\frac{1}{2}$ pie means 1 pie divided into 2 parts.

$\frac{1}{3}$ candy bar means 1 bar divided into 3 parts.

2. What do these mean? $\frac{3}{4}$ apple $\quad \frac{6}{3}$ apples

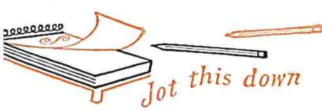
$\frac{2}{5}$ pie $\quad \frac{9}{6}$ cakes

3. Write 2 apples divided into 2 parts. Did you write $\frac{2}{2}$, or $2\overline{)2}$, or $2 \div 2$? Each way is right. $2 \div 2 = ?$

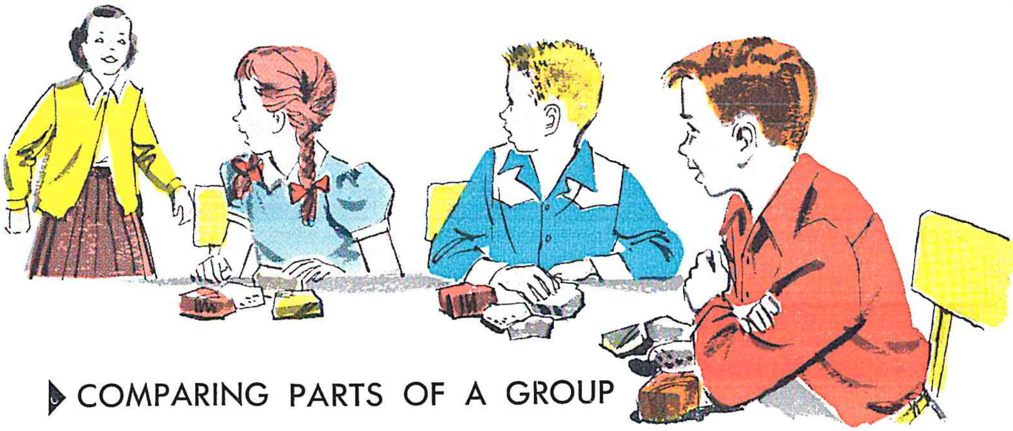
4. Write as a fraction 3 cupcakes divided into 6 parts.

5. Write 3 sandwiches divided into 4 parts.

6. Write 2 pies divided into 8 parts.



Do Set 1 on page 123. Tomorrow do Set 2 on page 123.



COMPARING PARTS OF A GROUP

Bob's uncle sent him 12 rocks for his mineral collection. He already had most of the kinds he received, so he is sharing the 12 rocks equally with two friends.

"Let's share with Linda, too," said Bob. "We'll each give her one."

1. When 3 children share 12 rocks equally, what fraction does each child get? How many rocks is that?

2. When 4 children share 12 rocks equally, what fraction does each child get? How many rocks is that?

3. What is $\frac{1}{3}$ of 12? What is $\frac{1}{4}$ of 12?

4. Which is larger:

a. $\frac{1}{3}$ of 24 or $\frac{1}{4}$ of 24?

b. $\frac{1}{2}$ of 8 or $\frac{1}{4}$ of 8?

c. $\frac{1}{5}$ of 15 or $\frac{1}{3}$ of 15?

d. $\frac{1}{3}$ of 12 or $\frac{1}{6}$ of 12?

e. $\frac{1}{8}$ of 16 or $\frac{1}{2}$ of 16?

f. $\frac{1}{6}$ of 12 or $\frac{1}{4}$ of 12?

g. $\frac{1}{5}$ of 10 or $\frac{1}{4}$ of 10?

h. $\frac{1}{3}$ of 12 or $\frac{1}{4}$ of 12?

5. Which is largest, $\frac{1}{2}$ of 16, $\frac{1}{4}$ of 16, or $\frac{1}{8}$ of 16?

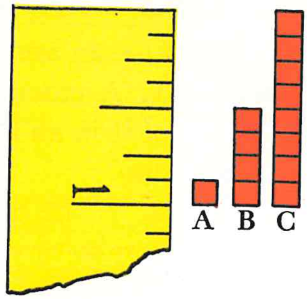
6. Which quotient is largest? **a.** $2\overline{)16}$ **b.** $4\overline{)16}$ **c.** $8\overline{)16}$

7. Choose the word that makes the best rule:

a. If a dividend remains the same, the bigger the divisor the (*bigger, smaller*) the quotient.

b. When the number in a denominator becomes larger, the size of the part becomes (*smaller, larger*).

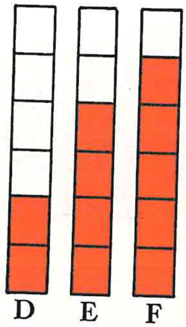
COMPARING FRACTIONS THAT HAVE THE SAME DENOMINATOR



1. One-eighth inch marks are shown on the three sticks, A, B, and C. What fraction of an inch is A? B? C?

2. Compare B and A. Which is larger? How much larger? What is the difference between $\frac{1}{8}$ and $\frac{4}{8}$?

3. Would a stick $\frac{3}{8}$ in. long come between A and B or B and C?



Between which two letters would a $\frac{5}{8}$-in. stick come?

4. What parts of sticks D, E, and F are colored?

5. How much larger is the colored part of E than the colored part of D?

6. What part of D is not colored?

7. Suppose you have several fractions of like things. All of the denominators are the same, as $\frac{3}{5}$, $\frac{2}{5}$, $\frac{1}{5}$, and $\frac{4}{5}$. How do you tell which fraction is largest?

Write these fractions in order of size, from smallest to largest:

8. $\frac{1}{4}$ $\frac{3}{4}$ $\frac{2}{4}$

9. $\frac{3}{8}$ $\frac{5}{8}$ $\frac{2}{8}$ $\frac{1}{8}$ $\frac{7}{8}$

10. $\frac{4}{6}$ $\frac{5}{6}$ $\frac{2}{6}$ $\frac{3}{6}$ $\frac{1}{6}$

11. $\frac{3}{5}$ $\frac{1}{5}$ $\frac{2}{5}$ $\frac{4}{5}$

What else do you need to know to tell

a. which is largest, $\frac{1}{3}$ apple or $\frac{1}{2}$ peach?

b. which is farther, $\frac{1}{2}$ of the way to Rock City or $\frac{1}{4}$ of the way to Clay Center?

c. which is larger, $\frac{3}{5}$ of Jim's melon or $\frac{2}{5}$ of Bob's?

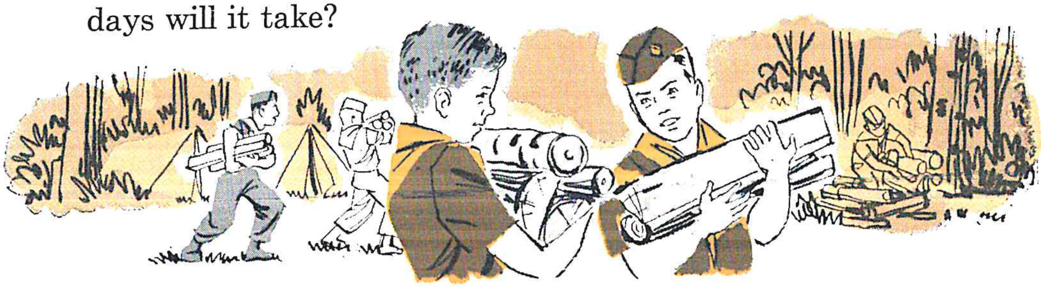
PROBLEMS AND PRACTICE

Use an answer sheet for these problems:

1. A mountain hike is 6 mi. The scoutmaster says to go $\frac{1}{3}$ of it in an hour. How many miles will the Scouts go in an hour?

2. If the Scouts go $\frac{1}{3}$ of the distance in 1 hr., how long will it take to go all the way at that rate?

3. Several Scouts are building a dam. They plan to build one fourth of it every day until they finish. How many days will it take?



4. Six Scouts must get firewood for 12 nights. How many nights is each one's equal share?

5. There are 48 Scouts in camp. That is exactly twice the number in camp last year. How many were in camp last year?

6. Will $\frac{1}{2}$ of a paper pie plate cover $\frac{2}{4}$ of the plate?

7. Which would you rather have, $\frac{1}{2}$ of a dime or $\frac{1}{5}$ of a quarter dollar?

8. Write a fraction whose denominator is 3 and whose numerator is 2.

9. Does the line between the numerator and the denominator mean *add*, *subtract*, *divide*, or *multiply*?

10. Which way would you write
2 apples divided by 3? → $\frac{2}{3}$ or $\frac{3}{2}$

11. If $\frac{3}{4}$ of the parents come to our play, will that be more than half of them?

PRACTICE

Set 1

1. $\begin{array}{r} 1831 \\ -937 \\ \hline \end{array}$ 2. $\begin{array}{r} 857 \\ \times 6 \\ \hline \end{array}$ 3. $7\overline{)6811}$ 4. $\begin{array}{r} 10688 \\ +645 \\ \hline \end{array}$ 5. $\frac{2}{5}$ of 25

6. $\frac{1}{8}$ of 5432 7. $\begin{array}{r} 478 \\ 77 \\ 796 \\ \hline \end{array}$ 8. $\begin{array}{r} 756 \\ -669 \\ \hline \end{array}$ 9. $\frac{3}{4}$ of 20 10. $\begin{array}{r} 468 \\ \times 90 \\ \hline \end{array}$

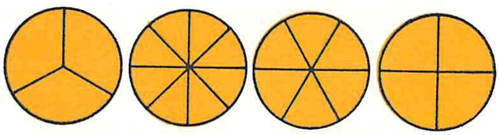
Set 2

1. Find: **a.** $\frac{1}{9}$ of 45; **b.** $\frac{1}{6}$ of 48; **c.** $\frac{1}{8}$ of 32; **d.** $\frac{2}{3}$ of 36.

2. Write with digits: **a.** three fourths **b.** four fifths **c.** seven eighths

3. Draw 3 rectangles each 2 in. long and 1 in. wide. Divide them into fourths in three different ways.

4. Which circle is divided into 4ths? 6ths? 3rds? 8ths?



A B C D

GROWTH TEST

1. Add 69, 83, 6, 84, and 79.
2. Multiply 976 by 4.
3. Take 3789 from 4355.
4. Add 39, 36, 78, 80 and 68.
5. $8676 \div 9 =$
6. Find $\frac{1}{8}$ of 6048.
7. $8 \times 489 =$
8. $1585 - 587 =$
9. $7\overline{)3202}$
10. $54 \times 408 =$
11. Find the difference between 690 and 1043.
12. Divide 4500 by 6.
13. $77 + 65 + 96 + 9 + 93$
14. Multiply 869 by 70.
15. $813 - 735 =$
16. What is $\frac{1}{4}$ of 3480?
17. Add 609, 55 and 9989.
18. $16 \times 689 =$
19. $9\overline{)3213}$
20. Find $\frac{3}{5}$ of 100.

UNIT 9

ADDING AND SUBTRACTING FRACTIONS

ADDING FRACTIONS WITH LIKE DENOMINATORS

1. Three girls will share equally the ribbon which Mrs. Kent gave them. What fraction will each girl have?

2. The 3 girls will also share some cloth equally. Jean said to Kathy, "I'll trade you my share of ribbon for your share of cloth." How much of the cloth will Jean get?

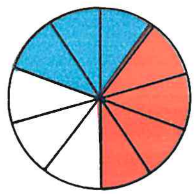
1 share	1 third	$\frac{1}{3}$
1 share	1 third	$\frac{1}{3}$
2 shares	2 thirds	$\frac{2}{3}$

$\frac{1}{3} + \frac{1}{3} = \frac{2}{3}$

1 quarter	$\frac{1}{4}$
1 quarter	$\frac{1}{4}$
2 quarters	$\frac{2}{4}$

3. Don had 1 quarter dollar and his mother gave him another. How much did he have then?

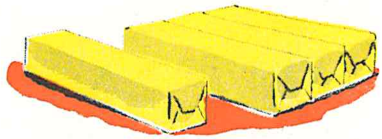
4. Mrs. Parks cut a cake into 10 pieces. If she and Bert and Peg eat 3 pieces at noon and the family eats 4 at night, how many will be eaten at both meals?



3 tenths	$\frac{3}{10}$
4 tenths	$\frac{4}{10}$
7 tenths	$\frac{7}{10}$

● When the denominators are the same, you have pieces, or parts, or shares that are the same size. Then you can add the numerators just as you add pieces or shares.

▶ SUBTRACTING FRACTIONS WITH LIKE DENOMINATORS



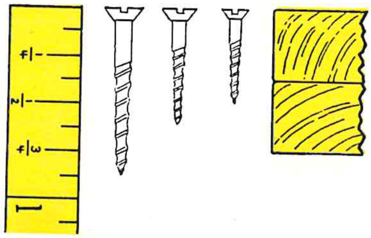
1. Mrs. Morgan has three quarters of a pound of butter. She uses one quarter. How many quarters are left?

$$\begin{array}{r} \frac{3}{4} \\ -\frac{1}{4} \\ \hline \frac{2}{4} \end{array}$$

Three fourths
minus one fourth
leaves two fourths.

$$\begin{array}{r} \text{3 quarters} \\ -\text{1 quarter} \\ \hline \text{2 quarters} \end{array} \qquad \begin{array}{r} \text{3 fourths} \\ -\text{1 fourth} \\ \hline \text{2 fourths} \end{array}$$

2. Tom has screws which are $\frac{1}{2}$ inch, $\frac{5}{8}$ inch, and $\frac{7}{8}$ inch long. Which length shall he use to fasten two $\frac{3}{8}$-in. boards together?



a. What will happen if Tom uses the $\frac{7}{8}$-in. screws? What is the difference between $\frac{6}{8}$ and $\frac{7}{8}$ in.?

b. The $\frac{1}{2}$-in. screw is how many eighths?

c. Will a $\frac{5}{8}$-in. screw go all the way through both boards? What is the difference between $\frac{6}{8}$ in. and $\frac{5}{8}$ in.?

3. Add:

a.	b.	c.	d.	e.	f.	g.
$\frac{1}{8}$	$\frac{1}{4}$	$\frac{2}{5}$	$\frac{3}{8}$	$\frac{5}{8}$	$\frac{1}{6}$	$\frac{2}{4}$
$\frac{2}{8}$	$\frac{1}{4}$	$\frac{2}{5}$	$\frac{2}{8}$	$\frac{2}{8}$	$\frac{4}{6}$	$\frac{1}{4}$

4. Subtract:

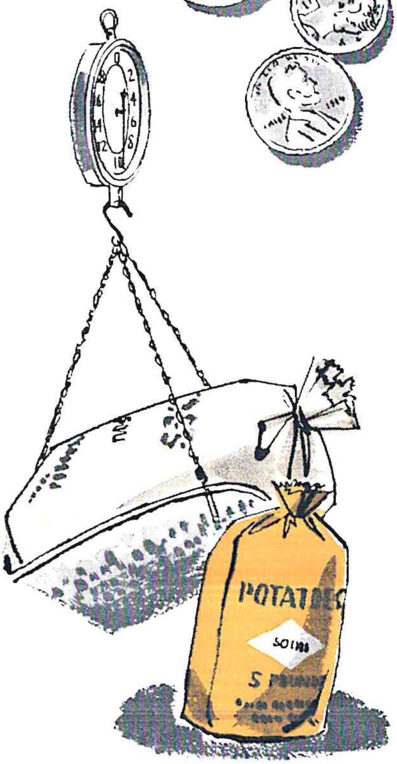
a.	b.	c.	d.	e.	f.	g.
$\frac{2}{3}$	$\frac{3}{4}$	$\frac{4}{5}$	$\frac{7}{8}$	$\frac{5}{6}$	$\frac{5}{8}$	$\frac{3}{5}$
$\frac{1}{3}$	$\frac{1}{4}$	$\frac{3}{5}$	$\frac{4}{8}$	$\frac{3}{6}$	$\frac{4}{8}$	$\frac{2}{5}$

5. Watch the signs:

a. $\frac{1}{4} + \frac{2}{4}$ **d.** $\frac{3}{4} - \frac{2}{4}$ **g.** $\frac{3}{5} + \frac{1}{5}$ **j.** $\frac{9}{10} - \frac{4}{10}$

b. $\frac{2}{5} - \frac{1}{5}$ **e.** $\frac{2}{3} - \frac{1}{3}$ **h.** $\frac{5}{8} - \frac{2}{8}$ **k.** $\frac{1}{3} + \frac{1}{3}$

c. $\frac{1}{8} + \frac{2}{8}$ **f.** $\frac{2}{6} + \frac{3}{6}$ **i.** $\frac{4}{6} - \frac{1}{6}$ **l.** $\frac{2}{10} + \frac{6}{10}$



YOU COMPARE LIKE THINGS

1. If you have six coins and give away 4 of them, how much money do you have left? Can you tell unless you know the value of the coins?

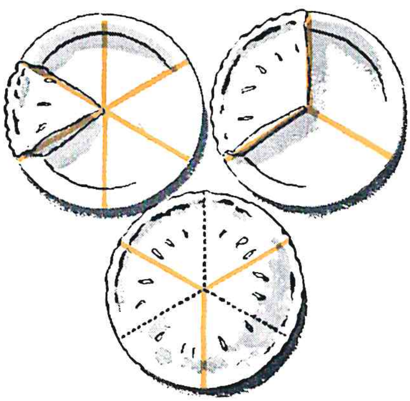
2. Can you subtract 5 oranges from 8 bricks? or 3 clocks from 6 shoes? or 5 hens from 10 marbles?

• We add or subtract only like things.

3. How much are 4 nickels and 2 dimes? Must you first think of the nickels and dimes as cents?

4. What is the difference between a large and a small sack of potatoes? The store clerk tells easily by weighing them. He changes "large" and "small" to numbers of pounds.

5. What part of a pie are a big piece and a little piece together? Can you tell without knowing the sizes of the pieces? Suppose they are $\frac{1}{6}$ and $\frac{1}{3}$?



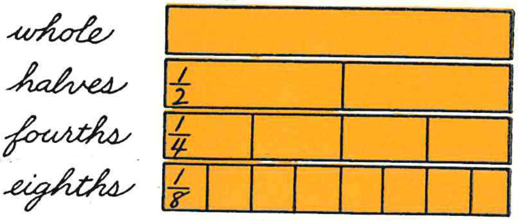
If each third of a pie is cut in the middle, how large will each piece be?

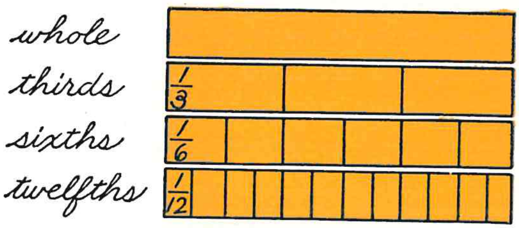
Does *one third* equal *two sixths*?

• You can compare *one third* and *one sixth* by changing one third to sixths, because you can add or subtract *like* things.

CHANGING TO LIKE DENOMINATORS

Ruth and Gary made two charts to use in changing fractions to like denominators so that they could add and subtract quickly. Gary wrote numbers along one edge. Who will make big charts like these for your class?





1. Use the charts to change these fractions:

$\frac{1}{2} = \frac{?}{4}$	$\frac{1}{3} = \frac{?}{6}$	$\frac{6}{8} = \frac{?}{4}$
$\frac{1}{4} = \frac{?}{8}$	$\frac{2}{3} = \frac{?}{6}$	$\frac{4}{6} = \frac{?}{3}$
$1 = \frac{?}{8}$	$\frac{1}{3} = \frac{?}{12}$	$\frac{4}{8} = \frac{?}{4}$
$\frac{3}{4} = \frac{?}{8}$	$\frac{4}{6} = \frac{?}{12}$	$\frac{8}{12} = \frac{?}{3}$

2. Use Ruth and Gary's charts to answer the examples below:

a. To find $\frac{1}{4} + \frac{3}{8}$, you change $\frac{1}{4}$ to $\frac{2}{8}$. Now you have like denominators. You can add *like* things, so $\frac{2}{8} + \frac{3}{8} = \frac{5}{8}$.

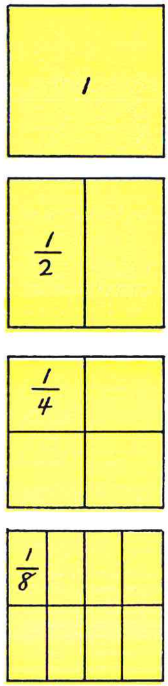
b. To find $\frac{5}{6} - \frac{1}{3}$, you change $\frac{1}{3}$ to $\frac{2}{6}$. Then $\frac{5}{6} - \frac{2}{6} = \frac{3}{6}$.

A	*B*
$\frac{1}{4} = \frac{2}{8}$	$\frac{5}{6} = \frac{5}{6}$
$+\frac{3}{8} = \frac{3}{8}$	$-\frac{1}{3} = \frac{2}{6}$
$\frac{5}{8}$	$\frac{3}{6}$

Answer these examples. Do them the same way as the examples in boxes *A* and *B*.

	a	b	c	d	e	f	g	h
3.	$\frac{1}{4} + \frac{1}{2}$	$\frac{3}{8} + \frac{1}{2}$	$\frac{1}{4} + \frac{5}{8}$	$\frac{1}{6} + \frac{1}{3}$	$\frac{1}{3} + \frac{3}{6}$	$\frac{1}{8} + \frac{1}{2}$	$\frac{1}{8} + \frac{1}{4}$	$\frac{2}{3} + \frac{1}{6}$
4.	$\frac{1}{2} - \frac{3}{8}$	$\frac{1}{2} - \frac{1}{8}$	$\frac{3}{4} - \frac{3}{8}$	$\frac{2}{3} - \frac{1}{6}$	$\frac{5}{6} - \frac{2}{3}$	$\frac{7}{8} - \frac{3}{4}$	$\frac{5}{6} - \frac{1}{3}$	$\frac{3}{4} - \frac{1}{8}$

CHANGING TO LIKE DENOMINATORS



Edward and Doris used fraction squares instead of charts to change fractions to like denominators. An 8-inch square is a good size.

1. Change these fractions:

a. $\frac{1}{2} = \frac{?}{8}$	**b.** $\frac{1}{2} = \frac{?}{4}$	**c.** $\frac{6}{8} = \frac{?}{4}$
d. $\frac{2}{4} = \frac{?}{2}$	**e.** $1 = \frac{?}{4}$	**f.** $\frac{1}{4} = \frac{?}{8}$
g. $\frac{4}{8} = \frac{?}{4}$	**h.** $\frac{2}{8} = \frac{?}{4}$	**i.** $\frac{3}{4} = \frac{?}{8}$

2. A half hour is how many quarter hours?

3. Helen can play with Jean $\frac{3}{4}$ hr. They have played $\frac{1}{2}$ hr. How long may they still play?

4. Two quarters of a pound of butter have been used. How much is left of the pound?

5. A half pound and a fourth pound of meat ground together will be how much meat?

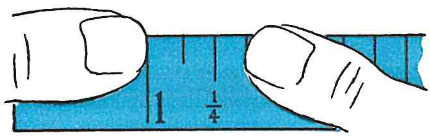
6. A glass of milk is $\frac{1}{4}$ of a quart. How many glasses are in a quart bottle that is half full?

7. There are 16 glasses of lemonade in a gallon. How many are there in a half gallon?

What part of a gallon is $\frac{8}{16}$ of a gallon?

What part of a gallon is $\frac{4}{16}$ of a gallon?

8. Harold puts his thumbs on his ruler and counts halves, quarters, and eighths. Try it.



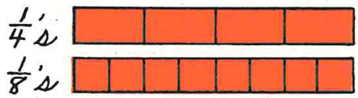
9. If you have paper ruled in $\frac{1}{8}$-in. squares, measure them with your ruler. How many make $\frac{1}{2}$ in.? $\frac{3}{4}$ in.?

- Like denominators are called **common** denominators.

CHANGING TERMS BY MULTIPLYING

1. "Here are some cent pieces," Dad said to Harold. "You may have your choice, $\frac{5}{8}$ or $\frac{3}{4}$ of them." Which do you think Harold chooses? Why?

2. How many eighths is $\frac{3}{4}$? Eight is how many fours? What number times 4 gives 8? If you multiply 4 by a number, what must you do to 3 to keep the value of the fraction the same?



$$\frac{2 \times 3}{2 \times 4} = \frac{6}{8}$$

- You can change the numerator and denominator of a fraction to larger digits by multiplying them by the same number. This does not change the value of the fraction.
- The numerator and denominator are called the **terms** of a fraction.

AN IDEA

$\frac{3}{4} = \frac{3}{4}$

$\frac{1}{2} = \frac{2}{4}$

3. Nancy wants a half yard of ribbon, but her mother thinks she should buy three quarters of a yard. Tell the difference by part of a yard and by inches.

4. Compare $\frac{2}{3}$ of a dozen with $\frac{5}{6}$ of a dozen.

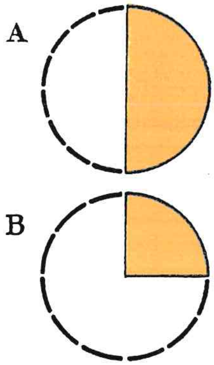
5. What is the difference between $\frac{3}{4}$ hr. and $\frac{1}{2}$ hr.? Tell the difference by part of an hour and by minutes.

6. The scales reads $\frac{7}{8}$ lb. for one piece of meat and $\frac{3}{4}$ lb. for another piece. What is the difference in weight as a fraction of a pound? in ounces?

7. Subtract. Then find a way to check your answers.

a. $\frac{3}{4}$	**b.** $\frac{1}{2}$	**c.** $\frac{5}{6}$	**d.** $\frac{5}{8}$	**e.** $\frac{2}{3}$	**f.** $\frac{7}{8}$	**g.** $\frac{3}{4}$	**h.** $\frac{5}{6}$
$\underline{\frac{1}{2}}$	$\underline{\frac{1}{8}}$	$\underline{\frac{1}{3}}$	$\underline{\frac{1}{4}}$	$\underline{\frac{1}{6}}$	$\underline{\frac{1}{2}}$	$\underline{\frac{3}{8}}$	$\underline{\frac{1}{6}}$

CHANGING THE NUMBERS IN FRACTIONS

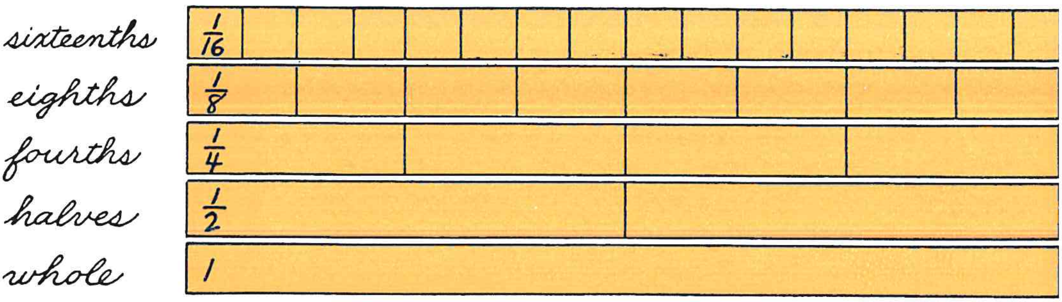


1. How large is the colored fraction of circle A? of circle B? Did you say $\frac{1}{2}$ and $\frac{1}{4}$?

2. The colored part of circle A is also $\frac{2}{4}$, $\frac{3}{6}$, $\frac{4}{8}$, $\frac{5}{10}$, $\frac{6}{12}$, and $\frac{8}{16}$. The colored part of circle B is also $\frac{2}{8}$, $\frac{3}{12}$, and $\frac{4}{16}$. Why didn't you think of one of these fractions instead of $\frac{1}{2}$ or $\frac{1}{4}$?

It is easier to think about fractions if the numerator and denominator are as small as we can make them.

Fred made a chart to change numerators and denominators to smaller numbers. He finds the size of the denominator at the left. Then he counts to the right, along the row, the number in the numerator. Then he goes down the line as far as it goes. That is as far as he can reduce the numerator and the denominator.



3. Find $\frac{2}{4}$. Does it equal $\frac{1}{2}$? Does $\frac{2}{4} = \frac{1}{2}$?

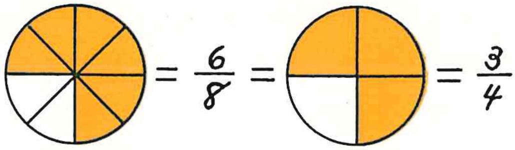
4. Find $\frac{10}{16}$. It equals $\frac{?}{8}$. Does $\frac{10}{16} = \frac{5}{8}$?

5. Change the numerator and the denominator of each fraction below to smaller numbers, but keep the value of each fraction the same. Use the chart.

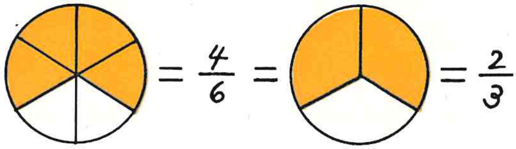
$\frac{4}{16}$ $\quad$ $\frac{8}{16}$ $\quad$ $\frac{4}{8}$ $\quad$ $\frac{2}{4}$ $\quad$ $\frac{2}{2}$ $\quad$ $\frac{6}{8}$ $\quad$ $\frac{12}{16}$ $\quad$ $\frac{2}{8}$

▶ CHANGING THE DIGITS IN A FRACTION

1. Does $\frac{6}{8} = \frac{3}{4}$?

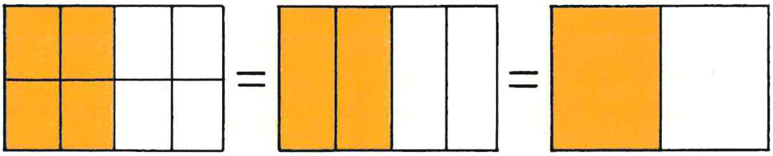


2. Does $\frac{4}{6} = \frac{2}{3}$?

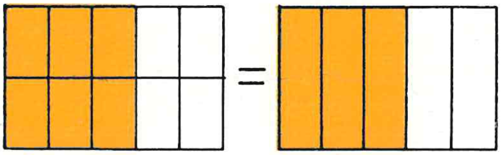


Write the numbers for these fractions:

3.



4.



5. Divide the numerator and the denominator of the fraction in (*A*) by 2. Does each divide evenly by 2?

A

$$\frac{2}{4} = \frac{2 \div 2}{4 \div 2} = \frac{1}{2}$$

6. Can you divide the 3 and 6 in (*B*) evenly by 2? Will they divide evenly by 3?

B

$$\frac{3}{6} = \frac{3 \div 2}{6 \div 2} = \frac{?}{?}$$

$$\frac{3}{6} = \frac{3 \div 3}{6 \div 3} = \frac{?}{?}$$

7. Does the value of the fraction in (*A*) remain the same?

8. Does the value of the fraction in (*B*) remain the same when you divide by 3?

9. Can you make a rule for changing the digits in a fraction without changing its value?

CHANGING FRACTIONS BY DIVIDING

1. Tell what happens to the divisions in each box:

$\begin{array}{r}2\\8\overline{)16}\end{array}$	$\begin{array}{r}2\\4\overline{)8}\end{array}$	$\begin{array}{r}2\\2\overline{)4}\end{array}$	$\begin{array}{r}2\\1\overline{)2}\end{array}$	$\begin{array}{r}3\\3\overline{)9}\end{array}$	$\begin{array}{r}3\\1\overline{)3}\end{array}$	$\begin{array}{r}4\\2\overline{)8}\end{array}$	$\begin{array}{r}4\\1\overline{)4}\end{array}$

When you divide the dividend and the divisor by the same number, is the quotient changed?

2. Fractions are divisions. Study these examples.

$$\frac{2}{4}=\frac{1}{2} \qquad \frac{2}{4}=\frac{(2\div 2)}{(4\div 2)}=\frac{1}{2} \qquad\qquad \frac{3}{6}=\,? \qquad \frac{3}{6}=\frac{(3\div 3)}{(6\div 3)}=\frac{1}{2}$$

$$\frac{6}{8}=\frac{3}{4} \qquad \frac{6}{8}=\frac{(6\div 2)}{(8\div 2)}=\frac{3}{4} \qquad\qquad \frac{4}{8}=\,? \qquad \frac{4}{8}=\frac{(4\div 4)}{(8\div 4)}=\frac{1}{2}$$

The **numerator** and the **denominator** are called the **terms** of a fraction. Changing a fraction to a lower numerator and a lower denominator is called **reducing to lower terms.**

3. Sometimes you may change the terms of a fraction, but not far enough. Then you change again to lowest terms. Which of these can be changed again?

$\frac{8}{16}=\frac{2}{4}$ $\qquad$ $\frac{6}{10}=\frac{2}{5}$ $\qquad$ $\frac{6}{12}=\frac{3}{6}$

4. Change each of these fractions to lowest terms:

a. $\frac{3}{6}$ **b.** $\frac{2}{4}$ **c.** $\frac{4}{12}$ **d.** $\frac{2}{8}$ **e.** $\frac{2}{6}$ **f.** $\frac{4}{16}$ **g.** $\frac{4}{10}$ **h.** $\frac{8}{16}$

i. $\frac{4}{8}$ **j.** $\frac{3}{12}$ **k.** $\frac{5}{10}$ **l.** $\frac{8}{12}$ **m.** $\frac{6}{8}$ **n.** $\frac{10}{16}$ **o.** $\frac{6}{12}$ **p.** $\frac{8}{10}$

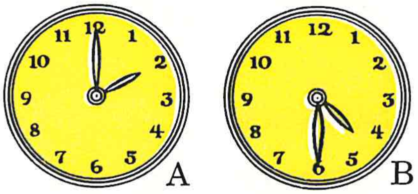
5. Add:

a. $\begin{array}{r}\frac{1}{8}\\ \underline{\frac{3}{8}}\end{array}$ **b.** $\begin{array}{r}\frac{1}{3}\\ \underline{\frac{1}{6}}\end{array}$ **c.** $\begin{array}{r}\frac{1}{8}\\ \underline{\frac{5}{8}}\end{array}$ **d.** $\begin{array}{r}\frac{1}{10}\\ \underline{\frac{2}{5}}\end{array}$

$$\begin{array}{r}\frac{1}{8}\\ \underline{\frac{3}{8}}\\ \frac{4}{8}=\frac{1}{2}\end{array}$$

6. Subtract:

a. $\begin{array}{r}\frac{5}{8}\\ \underline{\frac{1}{8}}\end{array}$ **b.** $\begin{array}{r}\frac{2}{3}\\ \underline{\frac{1}{6}}\end{array}$ **c.** $\begin{array}{r}\frac{1}{2}\\ \underline{\frac{3}{10}}\end{array}$ **d.** $\begin{array}{r}\frac{5}{6}\\ \underline{\frac{1}{3}}\end{array}$



MEANING OF A MIXED NUMBER

On Saturday at 2 P.M., Marilyn left to go to Marie's house. She arrived back home at 4:30 P.M. How long was she gone?

1. The small hand counts the hours. Did it move $2\frac{1}{2}$ spaces from its place on clock *A* to its place on clock *B*?

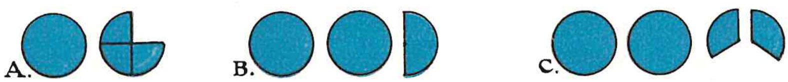
You read $2\frac{1}{2}$ as "two and one half." Always say "and" between a whole number and a fraction.

● Whenever a whole number and a fraction are used together, they are called a **mixed number.** The whole number and the fraction are not separate, but are "mixed," or put together.

2. Read these mixed numbers:

$1\frac{1}{2}$ $2\frac{1}{3}$ $3\frac{1}{4}$ $2\frac{2}{3}$ $3\frac{3}{8}$ $1\frac{1}{2}$

3. Say the numbers for these groups:



4. David brought coconut halves to school to make the sound of running horses for the radio program. How many coconuts did it take to make Row *A*? Row *B*? Row *C*? Row *D*?

● A fraction is always written at the right side of the ones. When you add or subtract, keep the columns straight. You keep tens under tens, ones under ones, and fractions under fractions.

ADDING WHOLE NUMBERS TO FRACTIONS AND MIXED NUMBERS

1. Rose had 2 dollars. Her father gave her a half dollar. How much did she then have?

The answer may be written $2\frac{1}{2}$ *dollars* or *\$2.50.* Sometimes, but not often, it is written $\$2\frac{1}{2}$.

Rose can add this way: → Be sure to put the fraction just to the right of ones' place.

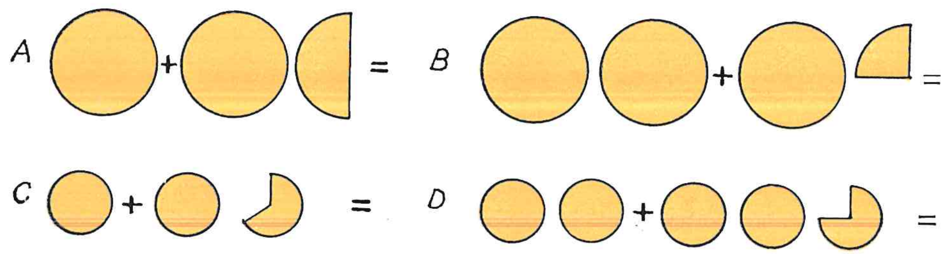
$$\begin{array}{rl} 2 & \text{dollars} \\ \frac{1}{2} & \text{dollar} \\ \hline 2\frac{1}{2} & \text{dollars} \end{array}$$

2. One coconut and $\frac{1}{2}$ coconut are __?__ coconuts.
Two coconuts and $1\frac{1}{2}$ coconuts are __?__ coconuts.
The two examples above may be written in two ways:

$1 + \frac{1}{2} =$ or $\begin{array}{r} 1 \\ +\frac{1}{2} \\ \hline \end{array}$

$2 + 1\frac{1}{2} =$ or $\begin{array}{r} 2 \\ +1\frac{1}{2} \\ \hline \end{array}$

3. Add these circles and parts:



Copy these examples and find the sums:

4. $\begin{array}{r} 2 \\ \frac{1}{2} \\ \hline \end{array}$	**5.** $\begin{array}{r} 2 \\ 1\frac{1}{2} \\ \hline \end{array}$	**6.** $\begin{array}{r} \frac{1}{2} \\ 1 \\ \hline \end{array}$	**7.** $\begin{array}{r} 1 \\ \frac{1}{4} \\ \hline \end{array}$	**8.** $\begin{array}{r} 1\frac{1}{4} \\ 1 \\ \hline \end{array}$	**9.** $\begin{array}{r} 1\frac{1}{3} \\ 1 \\ \hline \end{array}$

10. $1 + \frac{1}{2}$	**11.** $1 + 1\frac{1}{2}$	**12.** $\frac{1}{2} + 2$	**13.** $2 + \frac{1}{4}$
14. $2\frac{1}{4} + 1$	**15.** $2 + 1\frac{1}{3}$	**16.** $3 + \frac{1}{2}$	**17.** $2 + 2\frac{1}{2}$
18. $1\frac{1}{2} + 2$	**19.** $\frac{1}{3} + 2$	**20.** $2 + 2\frac{1}{4}$	**21.** $1 + 2\frac{1}{3}$

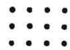
PRACTICE

Set 1

1. Write the fractions in **(a)**. Beside each write the words from **(b)** which go with it best.

a		b	
(1) $\frac{3}{3}$	(4) $\frac{1}{2} + \frac{2}{8}$	one half	three fourths
(2) $\frac{2}{8}$	(5) $\frac{7}{8}$	one whole	two thirds
(3) $\frac{4}{8}$	(6) $\frac{4}{6}$	nearly a whole	one fourth

2. $\frac{1}{2}$ hr. = __?__ min. $\frac{1}{2}$ ft. = __?__ in. $\frac{1}{2}$ yd. = __?__ in.

3. How many cookies are $\frac{1}{2}$ dozen? $\frac{3}{4}$ dozen? 

4. How many half pints are in 3 pints?

5. How many half pints equal 1 quart? 1 gallon?

6. Five children take equal shares of candy. Write the fraction that tells each one's share.

7. Three children take equal shares of 2 cups of nuts. Write the fraction that tells each one's share.

8. Which would you choose to have more?

a. $\frac{2}{5}$ or $\frac{3}{5}$ of a pie? **c.** $\frac{5}{8}$ or $\frac{1}{2}$ of some money?

b. $\frac{1}{3}$ or $\frac{1}{4}$ of a melon? **d.** $\frac{2}{6}$ or $\frac{2}{3}$ of 1 lb. of candy?

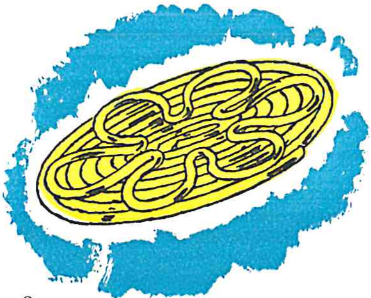
9. John has 1 hour until bedtime. If he practices his drums $\frac{3}{4}$ hour and watches television $\frac{1}{4}$ hour, will there be any time left before his bedtime?

Set 2

List the letters in each row in order of the size that the products or the quotients will be. Start with the largest. Then work the examples to see if you were right.

	a	b	c	d	e
1.	$\begin{array}{r}789\\ \underline{4}\end{array}$	$\begin{array}{r}789\\ \underline{8}\end{array}$	$\begin{array}{r}789\\ \underline{9}\end{array}$	$\begin{array}{r}789\\ \underline{7}\end{array}$	$\begin{array}{r}789\\ \underline{6}\end{array}$
2.	$7\overline{)3255}$	$7\overline{)5173}$	$7\overline{)6545}$	$7\overline{)4788}$	$7\overline{)5789}$

ADDING MIXED NUMBERS AND FRACTIONS

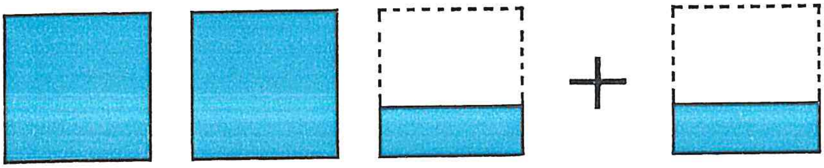


1. Ruth wants to make a pin for her mother for Christmas. It takes $1\frac{1}{3}$ yards of copper wire for the pin, and $\frac{1}{3}$ yard for the decoration. How much wire is that all together? Ruth adds to find out.

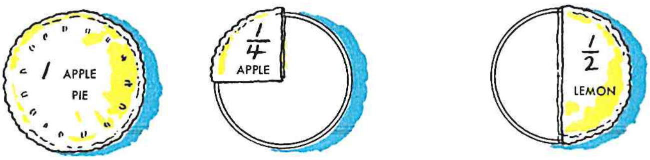
$$\begin{array}{r} 1\frac{1}{3} \\ \underline{\frac{1}{3}} \\ 1\frac{2}{3} \end{array}$$

2. How much are $1\frac{3}{8}$ inches and $\frac{3}{8}$ inch? Check with your ruler to see.

3. Add these squares and parts that are colored:



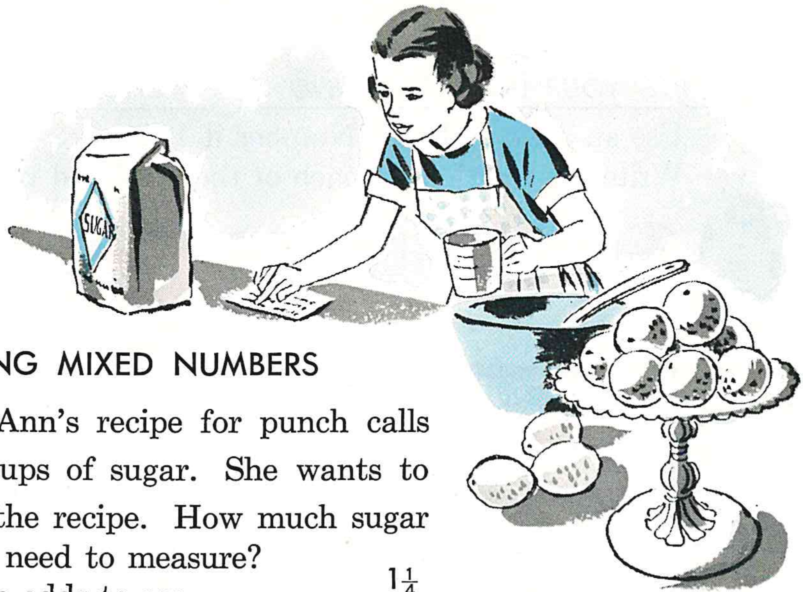
4. How much pie is shown in each picture below? How much apple pie? How much lemon? How much pie all together? Does $\frac{1}{2} = \frac{2}{4}$?



$$\begin{array}{rcr} 1\frac{1}{4} & = & 1\frac{1}{4} \\ \underline{\frac{1}{2}} & = & \underline{\frac{2}{4}} \\ & & 1\frac{3}{4} \end{array}$$

Copy and add these examples:

5. $\begin{array}{r} 2\frac{1}{3} \\ \underline{\frac{1}{3}} \end{array}$	**6.** $\begin{array}{r} \frac{2}{5} \\ \underline{1\frac{1}{5}} \end{array}$	**7.** $\begin{array}{r} 2\frac{3}{10} \\ \underline{\frac{4}{10}} \end{array}$	**8.** $\begin{array}{r} \frac{1}{3} \\ \underline{4\frac{1}{3}} \end{array}$	**9.** $\begin{array}{r} 3\frac{2}{5} \\ \underline{\frac{2}{5}} \end{array}$	**10.** $\begin{array}{r} 2\frac{1}{3} \\ \underline{\frac{1}{12}} \end{array}$
11. $\begin{array}{r} 1\frac{1}{2} \\ \underline{\frac{1}{4}} \end{array}$	**12.** $\begin{array}{r} \frac{1}{2} \\ \underline{3\frac{1}{8}} \end{array}$	**13.** $\begin{array}{r} 2\frac{1}{4} \\ \underline{\frac{1}{2}} \end{array}$	**14.** $\begin{array}{r} 1\frac{1}{6} \\ \underline{\frac{2}{3}} \end{array}$	**15.** $\begin{array}{r} \frac{1}{4} \\ \underline{2\frac{3}{8}} \end{array}$	**16.** $\begin{array}{r} 2\frac{1}{6} \\ \underline{\frac{1}{3}} \end{array}$
17. $\begin{array}{r} 1\frac{1}{4} \\ \underline{\frac{5}{8}} \end{array}$	**18.** $\begin{array}{r} \frac{3}{10} \\ \underline{1\frac{1}{5}} \end{array}$	**19.** $\begin{array}{r} 2\frac{1}{2} \\ \underline{\frac{3}{8}} \end{array}$	**20.** $\begin{array}{r} \frac{1}{2} \\ \underline{3\frac{3}{10}} \end{array}$	**21.** $\begin{array}{r} 2\frac{1}{2} \\ \underline{\frac{1}{6}} \end{array}$	**22.** $\begin{array}{r} 1\frac{1}{8} \\ \underline{\frac{1}{4}} \end{array}$



▶ ADDING MIXED NUMBERS

1. Ann's recipe for punch calls for $1\frac{1}{4}$ cups of sugar. She wants to double the recipe. How much sugar will she need to measure?

Ann adds to see.

She thinks, $\rightarrow \frac{2}{4} = \frac{1}{2}$

$$\begin{array}{r} 1\frac{1}{4} \\ \underline{1\frac{1}{4}} \\ 2\frac{2}{4} \end{array} = 2\frac{1}{2}$$

2. The recipe calls for $\frac{3}{4}$ cup of lemon juice and $1\frac{1}{3}$ cups of orange juice. How much of each will Ann need to double the recipe? Can you tell from the pictures below?

A *B*

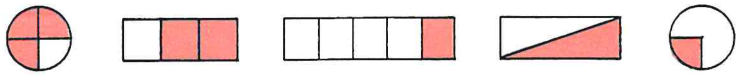
Copy and add. Change answers to lowest terms.

	a	b	c	d	e	f
3.	$1\frac{1}{3}$ $3\frac{1}{3}$	$2\frac{1}{5}$ $1\frac{3}{5}$	$3\frac{1}{4}$ $4\frac{1}{2}$	$2\frac{1}{8}$ $1\frac{1}{4}$	$2\frac{1}{4}$ $3\frac{1}{4}$	$1\frac{1}{6}$ $2\frac{1}{6}$
4.	$2\frac{1}{8}$ $1\frac{5}{8}$	$3\frac{1}{8}$ $2\frac{1}{2}$	$4\frac{1}{2}$ $2\frac{3}{8}$	$5\frac{2}{3}$ $2\frac{1}{6}$	$1\frac{1}{8}$ $1\frac{3}{8}$	$2\frac{3}{8}$ $4\frac{3}{8}$
5.	$1\frac{1}{2}$ $2\frac{1}{6}$	$1\frac{1}{16}$ $3\frac{4}{16}$	$2\frac{5}{12}$ $2\frac{1}{12}$	$2\frac{1}{3}$ $1\frac{1}{6}$	$1\frac{1}{2}$ $1\frac{1}{10}$	$2\frac{1}{12}$ $5\frac{1}{2}$

TESTING YOUR UNDERSTANDING OF FRACTIONS

Use an answer sheet. Number it 1–25.

Write the fraction for each of these colored parts:



1. **2.** **3.** **4.** **5.**

Write these fractions with numbers (as $\frac{1}{3}$):

6. three eighths **7.** four fifths **8.** five halves

9. Which is largest? $\frac{1}{6}$ $\frac{1}{8}$ $\frac{1}{2}$ $\frac{1}{4}$

10. Which is farthest? $\frac{1}{4}$ mi. $\frac{1}{2}$ yd. $\frac{1}{3}$ ft.

11. Which holds most? $\frac{7}{8}$ qt. $\frac{3}{4}$ pt. $\frac{1}{2}$ gal.

12. A pie is cut into 6 equal pieces. Is 1 or 6 the numerator for the amount of each piece?

13. $\frac{1}{3}$ yd. is _?_ ft. **14.** $\frac{1}{4}$ dozen is _?_.

15. A half foot is _?_ in.

16. With the same numerator, the larger the denominator, the (*larger*, *smaller*) will be the value of the fraction.

17. $\frac{2}{3}$ of 12 = _?_ **18.** $\frac{3}{4}$ of 12 = _?_

19. $\frac{2}{5}$ of 10 = _?_ **20.** $\frac{1}{2}$ of 60 = _?_

21. Two is what part of 8? $\frac{1}{2}$ $\frac{2}{3}$ $\frac{1}{4}$ $\frac{1}{8}$

22. Which is largest? $\frac{2}{5}$ $\frac{2}{4}$ $\frac{2}{3}$ $\frac{2}{8}$

23. Which of these does the line between the numerator and the denominator stand for?

a. addition **c.** multiplication

b. subtraction **d.** division

24. $\frac{3}{12} = \frac{1}{4}$, 3, 4, or 12?

25. Answer this one without figuring with a pencil. Will the quotient be largest for **a**, **b**, or **c**? for **d**, **e**, or **f**?

a	b	c	d	e	f
$1\overline{)8}$	$2\overline{)8}$	$4\overline{)8}$	$4\overline{)64}$	$4\overline{)96}$	$4\overline{)72}$

THE DIFFERENCE BETWEEN TWO MIXED NUMBERS

The ice-cream committee for the Washington's birthday party found that the cafeteria had $1\frac{3}{4}$ gallons of ice cream that could be used for their party. The cafeteria manager ordered 2 more gallons. "I'll use what you do not need," she told the committee. "Pay for just what you use."

1. How much ice cream was ready to be used?

2. After the party, the committee found that there were $1\frac{1}{2}$ gallons left. How much did the class use?

$$\begin{array}{rcr} 3\frac{3}{4} & = & 3\frac{3}{4} \\ -1\frac{1}{2} & = & 1\frac{2}{4} \\ \hline & & 2\frac{1}{4} \end{array}$$

Doris, the committee chairman, wrote $3\frac{3}{4}$ on the chalkboard. She placed the subtrahend directly under it. "Always put fractions right under fractions and the whole units under whole units," she said. Then Doris did these things:

- **a.** Changed the fractions to like denominators.
- **b.** Subtracted the fraction part.
- **c.** Subtracted the whole numbers.

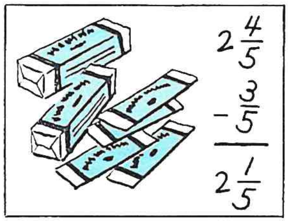
Changing the fraction to lowest terms is the next step. Is this step needed for this fraction?

Write a sentence to tell how much ice cream the class used.

3. Subtract:

a.	**b.**	**c.**	**d.**	**e.**	**f.**
$3\frac{5}{8}$	$3\frac{3}{4}$	$4\frac{5}{8}$	$4\frac{5}{6}$	$2\frac{3}{4}$	$3\frac{5}{6}$
$\underline{2\frac{1}{8}}$	$\underline{1\frac{1}{4}}$	$\underline{3\frac{1}{2}}$	$\underline{2\frac{1}{3}}$	$\underline{1\frac{3}{8}}$	$\underline{2\frac{1}{2}}$

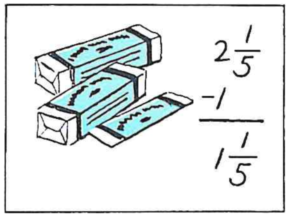
SUBTRACTING A WHOLE NUMBER OR A FRACTION FROM A MIXED NUMBER



1. Jerry has $2\frac{4}{5}$ packages of gum. Each package has 5 pieces. He gives Tom three pieces. How many packages are left?

Tom took $\frac{3}{5}$ of a package. $\frac{4}{5} - \frac{3}{5} = \frac{1}{5}$

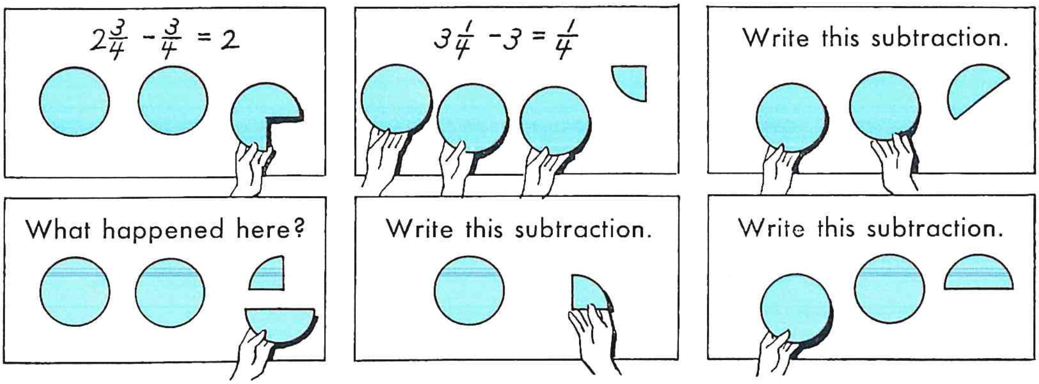
Was anything taken from the two whole packages?



2. Jerry has $2\frac{1}{5}$ packages of gum left. He gives 1 whole package to his sister. How much does he have left now?

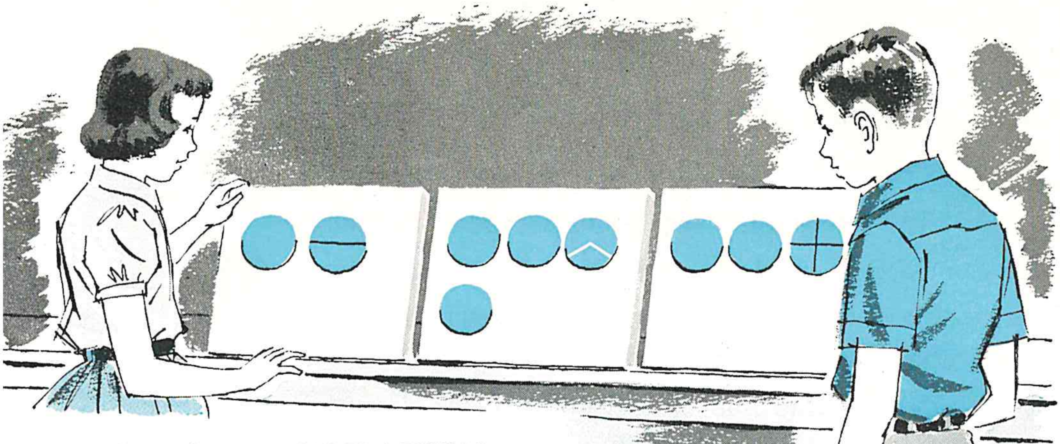
Was anything taken from the $\frac{1}{5}$ package? from the 2 whole packages?

3. Jerry's teacher made felt circles for seeing fractions. Can you see what is happening below?



Subtract. Use an answer sheet.

	a	b	c	d	e	f
4.	$8\frac{1}{2}$ 5	$2\frac{5}{6}$ $\frac{1}{3}$	$3\frac{1}{2}$ 2	$4\frac{3}{8}$ 3	$1\frac{4}{5}$ $\frac{3}{5}$	$1\frac{1}{2}$ $\frac{1}{4}$
5.	$3\frac{9}{10}$ $\frac{2}{5}$	$2\frac{2}{3}$ $\frac{1}{6}$	$2\frac{3}{4}$ $\frac{1}{4}$	$12\frac{3}{4}$ 8	$1\frac{7}{8}$ $\frac{1}{4}$	$16\frac{2}{3}$ 12



MORE ABOUT SUBTRACTION

Betty and Mike are showing how to subtract by using flannel boards. Answer these examples by looking at the flannel boards. Use an answer sheet.

1. Use the first flannel board. What is left

a. if you take $\frac{1}{2}$ circle away?

b. if you take 1 whole circle?

c. if you take 1 whole and 1 half circle?

2. Use the second flannel board. What is left if you take:

a. $\frac{2}{3}$ circle away?

b. 3 circles away?

c. 2 and $\frac{2}{3}$ circles away?

d. 1 and $\frac{1}{3}$ circles away?

3. Use the third flannel board. What is left if you take

a. 2 circles away?

b. $\frac{3}{4}$ circle away?

c. $2\frac{1}{2}$ circles away?

d. $\frac{1}{4}$ circle away?

e. $1\frac{3}{4}$ circles away?

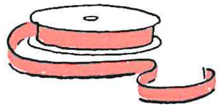
f. $2\frac{3}{4}$ circles away?

Subtract:

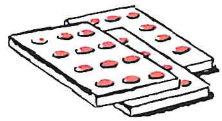
	a	b	c	d	e	f
4.	$3\frac{1}{2} - \frac{1}{2}$	$2\frac{1}{4} - 2$	$1\frac{2}{3} - \frac{2}{3}$	$2\frac{3}{4} - 2$	$1\frac{1}{3} - 1\frac{1}{3}$	$2\frac{5}{8} - \frac{5}{8}$
5.	$2\frac{3}{4} - \frac{1}{2}$	$1\frac{5}{8} - 1\frac{1}{2}$	$2\frac{5}{6} - 1\frac{1}{3}$	$3\frac{1}{2} - 3\frac{1}{4}$	$2\frac{2}{3} - 2\frac{1}{6}$	$1\frac{3}{4} - 1\frac{3}{8}$

PROBLEMS WITH FRACTIONS

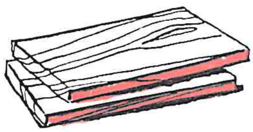
1. Jim watched television $\frac{1}{4}$ hr. and $\frac{1}{2}$ hr. How long did he watch both times?



2. Lucile bought $2\frac{1}{4}$ yd. of ribbon. She needed $\frac{1}{2}$ yd. more. How much should she have bought at first?



3. Jane has $2\frac{1}{2}$ dozen thumbtacks on cards. The mural will take $3\frac{3}{4}$ dozen in all. How many more are needed?



4. If one piece of lumber is $\frac{3}{8}$ in. thick, how thick will two of the pieces be?

5. What is the difference in thickness between a $\frac{7}{8}$-in. board and a piece of $\frac{1}{4}$-in. plywood?

6. The butcher marked one piece of meat $2\frac{7}{8}$ lb. He marked another $2\frac{1}{4}$ lb. What is the difference?

7. No pencil for this one! Jim has 2 whole candy bars. He gives Tommy half of a bar and Billy a quarter of a bar. How much does that leave Jim?

8. Mother has $\frac{2}{3}$ of a cherry pie and $\frac{2}{3}$ of an apple pie. How many pieces of pie, $\frac{1}{6}$ in size, can she get from $\frac{2}{3}$ and $\frac{2}{3}$?

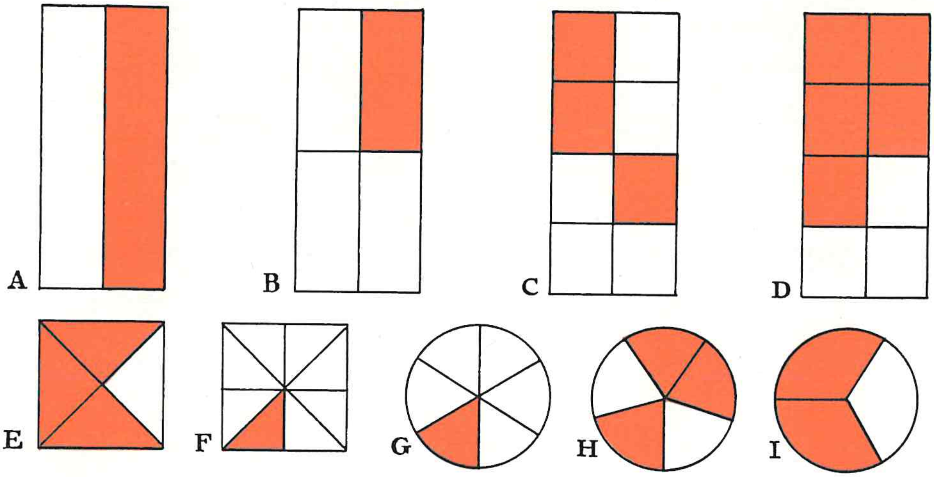
You have not studied all the kinds of subtractions below, but you can figure out the answers by making a drawing with a ruler:

Harold has two boards which are $\frac{5}{8}$ in. and $\frac{7}{8}$ in. thick.

a. What is the difference between their thickness when put together and the length of a $1\frac{1}{4}$-in. screw?

b. If he puts the screw through the $\frac{5}{8}$-in. board first, how far will it go into the $\frac{7}{8}$-in. board?

c. How far will it go into the $\frac{5}{8}$-in. board if he puts it through the $\frac{7}{8}$-in. board first?



UNIT TEST

Which of the figures above is:

1. $\frac{1}{4}$ colored? **4.** $\frac{3}{4}$ colored? **7.** $\frac{3}{5}$ colored?

2. $\frac{3}{8}$ colored? **5.** $\frac{1}{2}$ colored? **8.** $\frac{5}{8}$ colored?

3. $\frac{1}{6}$ colored? **6.** $\frac{2}{3}$ colored? **9.** $\frac{1}{8}$ colored?

10. Has *A*, *B*, *C*, or *D* the largest fraction colored?

11. Which figure has the smallest fraction colored?

What is the sum of the colored parts of:

12. *A* and *C*? **14.** *A* and *B*? **16.** *G* and *I*?

13. *B* and *C*? **15.** *E* and *F*? **17.** *B* and *D*?

18. Which figure shows the share of one person if 3 pies are divided among 5 persons?

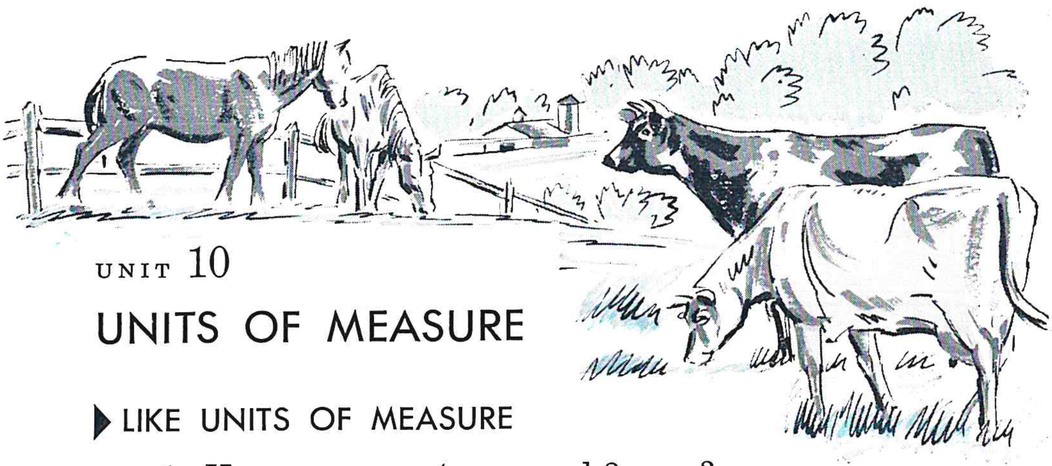
19. $\frac{1}{3} + \frac{1}{3}$ **24.** $\frac{12}{16} = \frac{?}{4}$ **29.** $2\frac{3}{4} - 1\frac{3}{8}$

20. $\frac{5}{8} - \frac{2}{8}$ **25.** $3\frac{1}{3} + 2$ **30.** $1\frac{3}{8} + 1\frac{1}{2}$

21. $\frac{3}{4} = \frac{?}{8}$ **26.** $\frac{3}{4} - \frac{1}{2}$ **31.** $2\frac{2}{5} - 2$

22. $3\frac{1}{2} - \frac{1}{2}$ **27.** $4 + \frac{3}{8}$ **32.** $2\frac{5}{6} - 2\frac{1}{3}$

23. $\frac{1}{8} + \frac{1}{4}$ **28.** $1\frac{1}{6} + \frac{1}{3}$ **33.** $2\frac{3}{4} - 1\frac{3}{4}$



UNIT 10

UNITS OF MEASURE

LIKE UNITS OF MEASURE

1. How many are 4 cows and 2 cows?

2. How many are 2 horses and 4 horses?

3. How many are 2 cows and 2 horses? You cannot say the answer is 4 cows. You cannot say it is 4 horses. What is a word that means cows and horses together?

4. How much are 4 dimes and 2 nickels? Kathy says, "6." She means 6 what?

ONE WAY

4 dimes = 8 nickels
2 nickels = 2 nickels

ANOTHER WAY

4 dimes = 40 cents
2 nickels = 10 cents

Do you know a name for both dimes and nickels?

If you have 6 coins, how many cents have you? What else do you need to know? When you add dimes and nickels, you must first think of them as like coins. Is a cent a coin?

5. Read "$3.50." Did you say fifty cents or 5 dimes?

6. How many are 2 tens and 3 ones? The answer is 23 what? ones?

7. How much are 1 gal. and 2 qt.? Can you say the answer in two ways?

8. Can you add 4 oranges and 3 apples? 3 pencils and 5 pieces of chalk?

Things must be alike in some way to be added.

HOW THINGS ARE ALIKE

A. These things are alike in some way. Tell how they are alike.

1. A dog and a cat
2. A house and a tent
3. A hammer and a saw
4. A farm and a garden
5. A ruler and a watch
6. A watch and a clock
7. A thermometer and a grocer's scale
8. A speedometer and an odometer
9. A gas meter and a water meter

B. These things are alike in a somewhat different way. Tell how they are alike.

1. An inch and a foot
2. A quart and a pint
3. A pound and an ounce
4. A dime and a cent
5. A minute and an hour
6. An inch and a mile
7. An ounce and a ton
8. A cent and a dollar
9. A minute and a year
10. A dozen and a pair

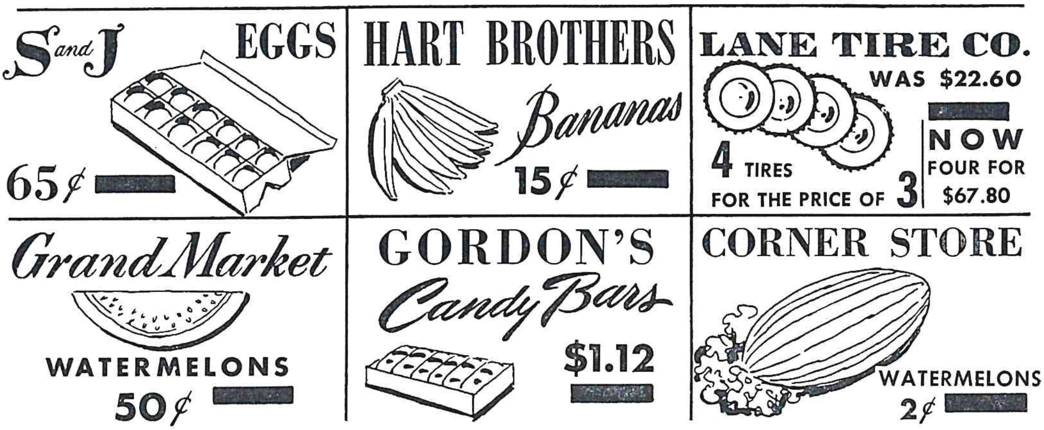
Are they measures?

C. Which pairs of these can be changed to the same unit of measure?

1. Feet and inches
2. Pounds and ounces
3. Hours and quarts
4. Yards and miles
5. Dollars and quarters
6. Days and weeks
7. Cups and gallons
8. Pints and minutes
9. Minutes and years
10. Pairs and dozens
11. Quarts and degrees
12. Pairs and pounds

D. Make a rule about adding, subtracting, multiplying, and dividing numbers of measures. Must the measures be the same kind? If they are different, must you change them?

THE FRIDAY SHOPPER



WHICH UNIT DO YOU USE?

Which unit (or two units) do you use when you measure each of the things below?

1. Long distances traveled by automobiles.

2. The height of boys and girls.

3. The length of a ball of string for a kite.

4. Several eggs.

5. Large numbers of eggs.

6. Gasoline bought at a filling station.

7. Sugar in cooking.

8. Cake mix or flour.

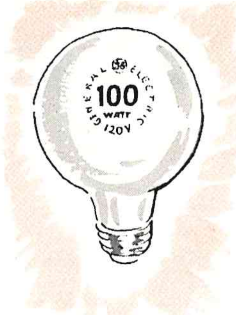
9. Watermelons. Are two units often used?

10. Milk. Is milk ever weighed?

11. Why are some things, like potatoes and milk, often measured by more than one kind of measure?

12. Read *The Friday Shopper* at the top of this page. Do you think the Grand Market is charging 25 times as much for watermelons as the Corner Store is charging? What do you think is blacked out in each picture?

▶ OTHER MEASURES



1. How do you tell the size of an electric light bulb? Look at the end of a bulb, but not while the light is turned on. It may say 40 W, 60 W, 100 W, or 200 W. Are there other sizes, too? *W* stands for **watts.** The size of a light bulb tells how much electricity it uses.

2. Bicycle sizes are measured by inches. Can you ride a 20-in. bicycle better than a 26-in. one? The size of a bicycle is measured across the middle of the wheel. It is the **diameter** of the wheel.

3. Have you ever heard of a **bale** of hay or a **bale** of cotton?

4. Sizes of some clothes are given by ages. If you are 10 years old and somewhat bigger than average, would you need size 9 or 11?

5. Which shoe is wider, size 5A or 5D?

6. Where are spoons used often for measuring?

7. How much is a pinch of salt? Sometimes a cooking recipe calls for a pinch of salt.

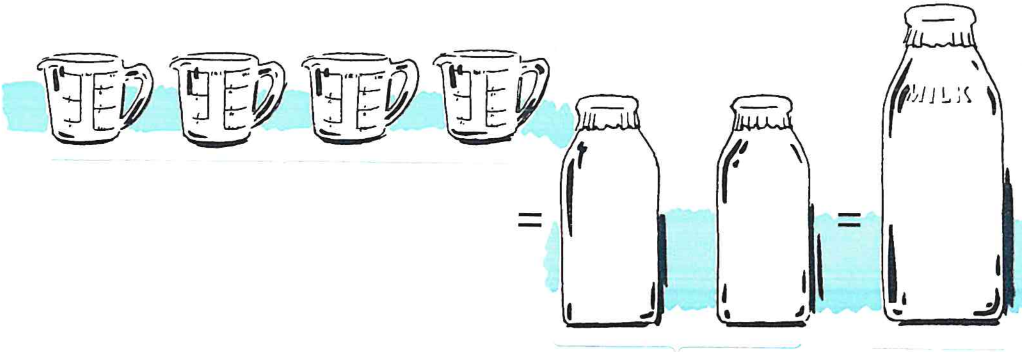
8. Coloring for cake frosting is measured by *drops.* Do you know anything else measured by drops?

9. How are small amounts of vitamins or medicine measured?

A tablet or a capsule is often used as a measure. The exact amount is put in them at the laboratory because most people do not have scales small enough to measure such small amounts.

10. You know the number measures of *pair* and *dozen.* Do you know these?

score = 20	*quartet* = 4	*trio* = 3	*gross* = 144
octet = 8	*single* = 1	*ream* = 500 sheets	



CHANGING UNITS OF MEASURES

1. An ordinary drinking glass is about the size of a measuring cup. How many glasses of milk will 1 qt. serve?

2. If 1 qt. serves 4 glasses, how many glasses will 2 qt. serve? 4 qt.? 3 qt.? 5 qt.?

3. How many glasses will 1 pt. serve? 3 pt.?

4. How many glasses will be served from 2 qt. and 1 pt.?

5. When the multiplicand gets larger and the multiplier stays the same, what happens to the product?

Number quarts	More quarts
$\times 2$	$\times 2$
Number pints	? ?

6. You have 20 quarters. You want to change them for dollars. Do you multiply or divide? Explain.

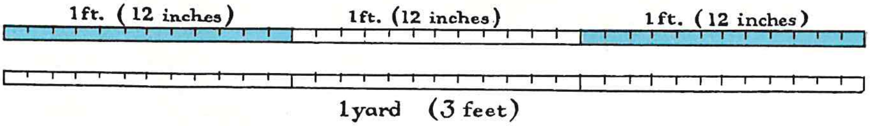
7. If you want to change a number of units of measure to larger units, do you multiply or divide?

8. Try your rule with money. You have 10 nickels. You want to change them for dimes. Do you multiply or divide? Explain.

9. If you want to change units of measure to smaller units, do you multiply or divide? Change 2 yards to feet.

10. Two gallons are how many quarts? Two dollars are how many dimes? Two quarts are how many pints?

CHANGING UNITS OF MEASURES (continued)



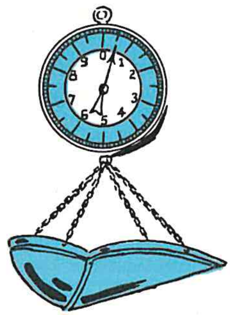
1. A schoolroom is 9 yd. wide. Do you multiply or divide to find how many feet? 9 yd. = __?__ ft.

2. You know the number of inches long a distance is. How would you find the number of feet long? the number of yards long?

3. Jack can run and jump 2 yd. and 2 ft. more. How many feet is that distance?

4. Darlene's sister is 5 ft. 2 in. tall. How many inches tall is she?

5. The lines on a football field are 30 ft. apart. How many yards apart are they?



6. How many ounces are in a pound of apples? in a half pound?

7. How else can you say 2 lb. 8 oz.? 2 lb. 4 oz.? $1\frac{1}{4}$ lb.? $\frac{3}{4}$ lb.? $\frac{1}{4}$ lb.?

8. If you are weighing nuts and have 13 oz., you need how much more to make 1 lb.?

9. Joe is 4 ft. 8 in. tall. How many inches must he grow to be 5 ft. tall?

10. 2 ft. = __?__ in.

11. 24 qt. = __?__ gal.

12. 10 qt. = __?__ gal.

13. 2 lb. = __?__ oz.

14. 1 gal. = __?__ pt.

15. 2 gal. = __?__ qt.

16. 24 in. = __?__ ft.

17. $\frac{1}{2}$ lb. = __?__ oz.

18. $\frac{3}{4}$ hr. = __?__ min.

19. 12 ft. = __?__ yd.

20. 1 yd. = __?__ in.

21. 10 pt. = __?__ qt.

22. $2\frac{1}{2}$ ft. = __?__ in.

23. 5 ft. = __?__ yd.

24. 3 pt. = __?__ qt.

25. 3 yd. = __?__ ft.

26. 18 in. = __?__ ft.

27. 75 min. = __?__ hr.

ESTIMATING OTHER UNITS

In each problem choose the answer that is nearest your estimate:

1. Bob's kite string is 275 ft. long. That is about: **a.** 25 yd. **b.** 90 yd. **c.** 200 yd. **d.** 800 yd.

2. There are 16 girls who need 27 in. of ribbon each. The total amount of ribbon needed is about: **a.** 9 yd. **b.** 12 yd. **c.** 27 yd. **d.** 81 yd.

3. Jane says \$3 worth of nickels to make change would be: **a.** 3 nickels **b.** 15 nickels **c.** 60 nickels **d.** 150 nickels

4. A hundred inches would most nearly equal: **a.** 8 ft. **b.** 12 ft. **c.** 100 ft. **d.** 1200 ft.

5. A 24-hr. day would be about: **a.** 144 min. **b.** 240 min. **c.** 400 min. **d.** 1440 min.

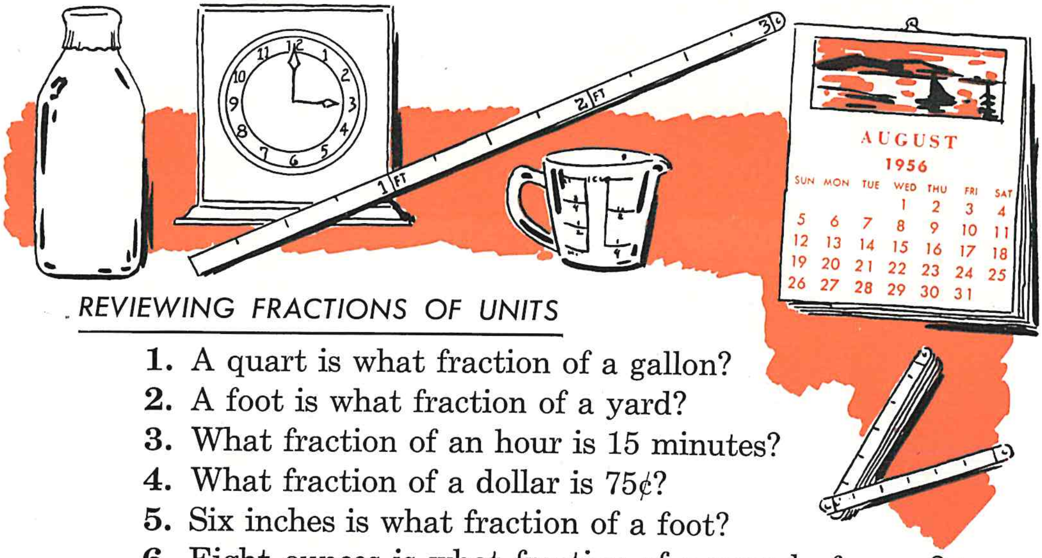
6. A mile a minute would be how many miles an hour? **a.** 10 **b.** 36 **c.** 60 **d.** 360

7. About how long is this line? Do not measure it.

a. $\frac{1}{8}$ ft. **b.** $\frac{1}{3}$ ft. **c.** $\frac{2}{3}$ ft. **d.** $\frac{3}{4}$ ft.

8. A five-gallon can of oil would have how many quarts? **a.** $2\frac{1}{2}$ **b.** 10 **c.** 20 **d.** 40

9. The tallest mountain peaks in Colorado, California, and Washington are not quite 15,000 ft. high. That height is nearest: **a.** 1 mi. **b.** 3 mi. **c.** 5 mi. **d.** 10 mi.



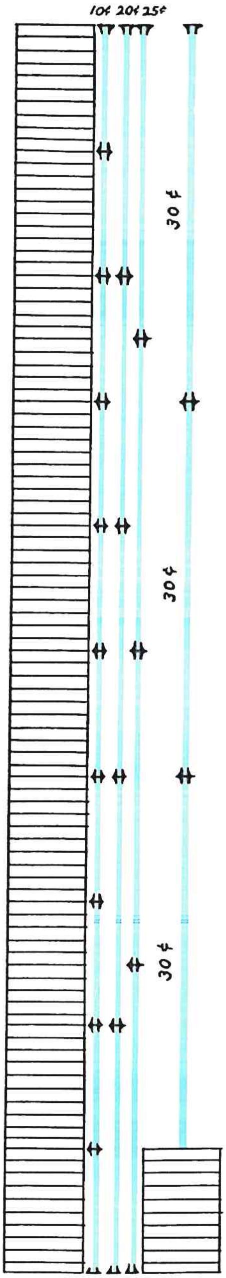
REVIEWING FRACTIONS OF UNITS

1. A quart is what fraction of a gallon?
2. A foot is what fraction of a yard?
3. What fraction of an hour is 15 minutes?
4. What fraction of a dollar is 75¢?
5. Six inches is what fraction of a foot?
6. Eight ounces is what fraction of a pound of sugar?
7. How many inches is a half yard?
8. How many ounces is a quarter pound?
9. How many pints is a half gallon?
10. Three quarters of an hour is how many minutes?

GROWTH TEST

1. Take 937 from 1861.
2. Multiply 857 by 6.
3. $\frac{1}{5} + \frac{3}{5} = \underline{\ ?\ }$
4. $6811 \div 7 = \underline{\ ?\ }$
5. $\frac{5}{6} - \frac{1}{6} = \underline{\ ?\ }$
6. Find $\frac{1}{5}$ of 205.
7. $29 \times 468 = \underline{\ ?\ }$
8. $2\frac{2}{3} - 1\frac{2}{3} = \underline{\ ?\ }$
9. $3\frac{1}{3} + \frac{1}{6} = \underline{\ ?\ }$
10. Add 478, 79, 90, and 786.
11. Divide 5789 by 6.
12. $1\frac{1}{2} + 2\frac{3}{8} = \underline{\ ?\ }$
13. $3156 - 2669 = \underline{\ ?\ }$
14. What is $\frac{2}{3}$ of 144?
15. $5\frac{3}{4} - 2\frac{5}{8} = \underline{\ ?\ }$
16. Find the product of 850 and 18.
17. Find the sum of 10,585 and 786.
18. Find the difference between 778 and 1045.
19. What is the quotient of 9920 divided by 4?
20. What is $37 + 89 + 78 + 79 + 67$?

UNIT 11



DIVIDING BY MORE THAN NINE

DIVIDING A DOLLAR

A dollar can be divided in many ways. It will first have to be exchanged for other coins.

1. If you have a dollar, to how many people can you give 10¢ each?

2. To how many can you give 20¢ each?

3. How many can have 25¢ each?

4. How many tens are there in 100? How many twenties? How many twenty-fives?

5. If you have 100 cents, to how many people can you give 30 cents each? Look at the column which has only a few cents left. Thirty cents can be given to each of 3 people. How many cents are left out of a dollar?

6. How many dimes are in 50¢? 50¢ ÷ 10¢

7. How many quarters in \$1? 100¢ ÷ 25¢

8. How many quarters in 50¢? 50¢ ÷ 25¢

9. How many dimes in \$1.50? 150¢ ÷ 10¢

10. How many quarters in \$2? 200¢ ÷ 25¢

11. How many half dollars in \$1? 100¢ ÷ 50¢

12. How many half dollars in \$2? 200¢ ÷ 50¢

13. How many dimes in \$3? 300¢ ÷ 10¢

Answer without figuring on paper:

14. 20 ÷ 10 **15.** 40 ÷ 20 **16.** 25 ÷ 10

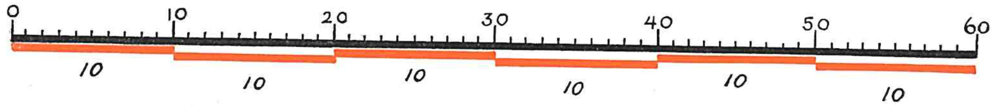
17. 30 ÷ 10 **18.** 60 ÷ 30 **19.** 22 ÷ 10

20. 70 ÷ 10 **21.** 80 ÷ 20 **22.** 35 ÷ 10

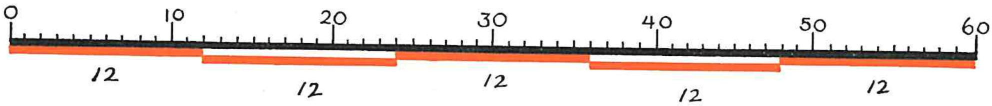
▶ SEEING DIVISION

Don wanted to see how division works. He made a marker 60 inches long and marked it in tens. Then he laid sticks of different lengths beside it to see how many of them he could measure in 60 inches.

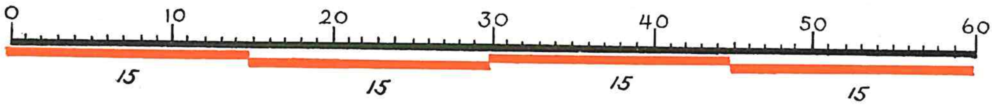
1. Don first measured 60 by 10. Count the tens in 60.



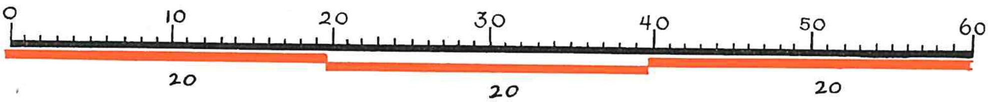
2. Count the twelves Don measured in 60.



3. How many fifteens are there in 60?



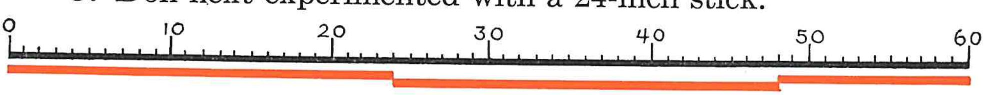
4. How many twenties are there in 60?



Check Don's thinking: → $\begin{array}{r}10\\ \times 6\\ \hline\end{array}$ $\begin{array}{r}12\\ \times 5\\ \hline\end{array}$ $\begin{array}{r}15\\ \times 4\\ \hline\end{array}$ $\begin{array}{r}20\\ \times 3\\ \hline\end{array}$

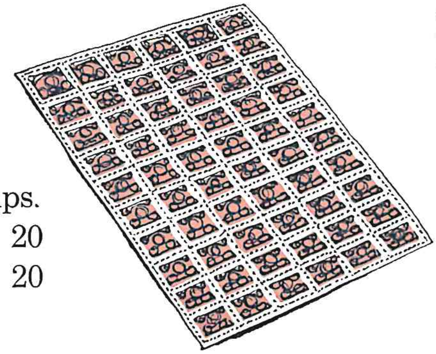
Was he right?

5. Don next experimented with a 24-inch stick.

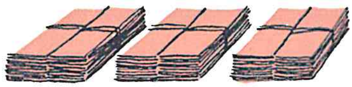


"There are more than 2 twenty-fours in 60," said Don, "but there aren't 3." He found that he used just half of the third measurement. "I'd say that 60 divided by 24 is $2\frac{1}{2}$," said Don. Do you think he was right?

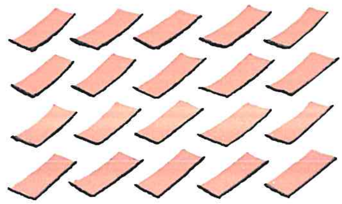
▶ DIFFERENT WAYS TO SEE DIVISION HAPPEN



1. Don has a sheet of 60 stamps. He wants to tear it into groups of 20 stamps each. How many groups of 20 will he have?

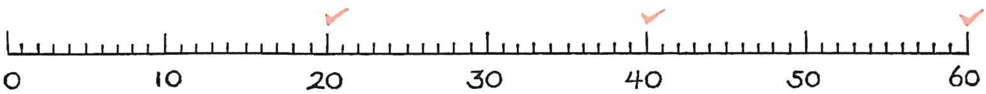


2. Doris has 60 tickets. They are in packs of 10 tickets each. She divides 60 by 20 by taking away groups of 20 as many times as she can.



3. Tom has 60 tickets that he wants to divide among 20 children. He starts 20 piles and deals his 60 tickets until they are gone. How many times will they go around?

4. How many 20-inch pieces can Gloria get from 60 inches of ribbon? She used a number line to find out.



5. In each of the four ways above, a pupil took rows, or packs, or layers, or marks of groups of 20. You do it the same way with numbers.

$$\begin{array}{r} 60 \\ -20 \\ \hline 40 \text{ left} \end{array} \nearrow \begin{array}{r} 40 \\ -20 \\ \hline 20 \text{ left} \end{array} \nearrow \begin{array}{r} 20 \\ -20 \\ \hline \text{none left} \end{array} \Big\} \text{ 20 was taken out 3 times.}$$

6. In division you take the 3 twenties out of 60 all at one time. Is all of the 60 used? →

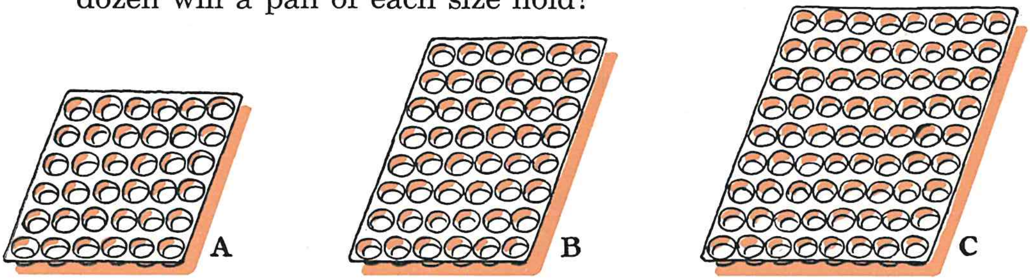
$$\begin{array}{r} 3 \\ 20\overline{)60} \\ \underline{60} \end{array}$$

7. Divide:

a. $20\overline{)40}$ **b.** $20\overline{)60}$ **c.** $30\overline{)90}$ **d.** $40\overline{)80}$ **e.** $30\overline{)60}$

▶ DIVIDING BY TENS AND ONES

1. The school cafeteria uses pans of different sizes to bake muffins. Three sizes bake 36, 48 and 72. How many dozen will a pan of each size hold?



Betty thought out the first two answers very easily. She looked at the half dozens in the rows. How many dozens do you see in pan *A* (6×6)? in pan *B* (6×8)?

Betty knows the products of dozens. She writes:

12 24 36 48 60 72 84 96

A. $6 \times 6 = 36$ $\quad 36 \div 12 = 3$ doz.
B. $6 \times 8 = 48$ $\quad 48 \div 12 = 4$ doz.
C. $9 \times 8 = 72$ $\quad 72 \div 12 = \underline{\ ?\ }$

Betty says, "Six dozen are 72. So $72 \div 12 = 6$."

2. Check Betty's thinking in two ways:

a

$$\begin{array}{r} 3 \\ 12\overline{)36} \\ \underline{36} \end{array} \qquad \begin{array}{r} 12 \\ \underline{\times 3} \\ 36 \end{array}$$

b

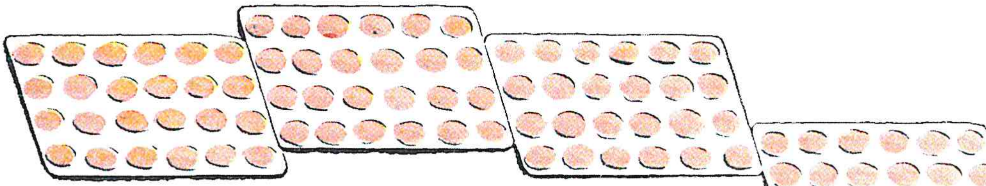
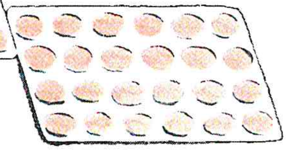
$$\begin{array}{r} 12\overline{)48} \end{array} \qquad \begin{array}{r} 12 \\ \underline{\times 4} \end{array}$$

c

$$\begin{array}{r} 12\overline{)72} \end{array} \qquad \begin{array}{r} 12 \\ \underline{\times 6} \end{array}$$

3. There are 64 muffins for 32 children. How many will there be for each child? Will $64 \div 32$ be about the same as $60 \div 30$? Try 2 in the quotient. It is 2 ones, so put it above the 4 ones. $2 \times 32 = 64$. Will sixty-four muffins go around twice for 32 children?

$$\begin{array}{r} 2 \\ 32\overline{)64} \\ \underline{64} \end{array}$$

AN EASY WAY TO THINK OF QUOTIENTS

1. Suppose you have 96 small cupcakes to divide among 32 children. 32 cupcakes are 1 for each child.

Think *32 is about 30. 96 is about 90.*

There are 3 thirties in 90.

There will be about 3 thirty-twos in 96. $3 \times 32 = 96$. You can take thirty-two out of 96 three times.

$96 - 96 = 0$. There is none left.

If 96 cupcakes are divided among 32 children, each child will get 3 cupcakes. $3 \times 32 = 96$.

$32\overline{)96}$

think:

$30\overline{)90}$

$$\begin{array}{r} 3 \\ 30\overline{)90} \end{array}$$

$$\begin{array}{r} 3 \\ 32\overline{)96} \\ \underline{96} \end{array}$$

2. Has anyone made a discovery about the tens' digits? Look at the tens' digit in each divisor and each dividend.

$$\begin{array}{r} 2 \\ 21\overline{)42} \\ \underline{42} \end{array} \qquad \begin{array}{r} 3 \\ 23\overline{)69} \\ \underline{69} \end{array} \qquad \begin{array}{r} 3 \\ 31\overline{)93} \\ \underline{93} \end{array} \qquad \begin{array}{r} 2 \\ 42\overline{)84} \\ \underline{84} \end{array} \qquad \begin{array}{r} 4 \\ 21\overline{)84} \\ \underline{84} \end{array}$$

3. What quotient digit do you get if you divide the tens' digit of the dividend by the tens' digit of the divisor? Can you make a rule?

• The first step in finding the quotient is to try to divide the first digit of the dividend by the first digit of the divisor.

PRACTICE

1. $21\overline{)42}$	**2.** $12\overline{)36}$	**3.** $11\overline{)55}$	**4.** $24\overline{)48}$	**5.** $32\overline{)96}$
6. $41\overline{)82}$	**7.** $12\overline{)24}$	**8.** $23\overline{)69}$	**9.** $14\overline{)28}$	**10.** $31\overline{)62}$

▶ USING THE FIRST TWO DIGITS OF THE DIVIDEND

1. George bought 63 lb. of chicken feed for his 4-H Club chickens. He says sixty-three pounds is just enough for three weeks. How many pounds does he feed each day? How many days are there in 3 weeks?

How many twos are there in 6? Write the answer in ones' place. Then multiply 21 by 3. Subtract 63 from 63. Is there a remainder?

How many pounds does George feed daily?

$$\begin{array}{r} 3 \\ 21\overline{)63} \\ \underline{63} \end{array}$$

2. We have already learned that there are 6 twenties in 120.

120 ÷ 20 is 12 tens ÷ 2 tens = __?__

$$20\overline{)120}$$

$$2\text{ tens}\overline{)12\text{ tens}}$$

3. 126 = __?__ tens and __?__ ones. See 12 ÷ 2 = 6. Do you think the quotient digit will be 6? Try it. Is it right?

Is 6 written in ones' place?

$$21\overline{)126}$$

$$\begin{array}{r} 6 \\ 21\overline{)126} \\ \underline{126} \end{array}$$

● In finding the quotient, if the first digit of the divisor is larger than the first digit of the dividend, use the first two digits of the dividend.

Find the quotients:

	a	b	c	d	e	f
4.	$23\overline{)46}$	$32\overline{)96}$	$22\overline{)88}$	$41\overline{)82}$	$31\overline{)62}$	$12\overline{)48}$
5.	$21\overline{)168}$	$32\overline{)128}$	$21\overline{)147}$	$42\overline{)168}$	$71\overline{)426}$	$62\overline{)248}$
6.	$81\overline{)486}$	$91\overline{)455}$	$72\overline{)288}$	$52\overline{)156}$	$82\overline{)328}$	$92\overline{)276}$
7.	$90\overline{)720}$	$80\overline{)560}$	$60\overline{)480}$	$70\overline{)630}$	$40\overline{)360}$	$50\overline{)350}$

▶ DIVIDING REMAINDERS

1. Dot and Tom have 3 oranges to eat. How can they divide 3 by 2? Will each have $1\frac{1}{2}$ oranges?

First you divide 3 by 2. The answer is 1 orange for Dot and 1 for Tom. But there is another orange left over. If you divide one orange for two people, how much will each person get? $1 \div 2 =$ _?_ Does 3 oranges $\div\ 2 = 1\frac{1}{2}$ oranges?

$$\begin{array}{r} 1\frac{1}{2} \\ 2\overline{)3} \\ \underline{2} \\ 1 \end{array}$$

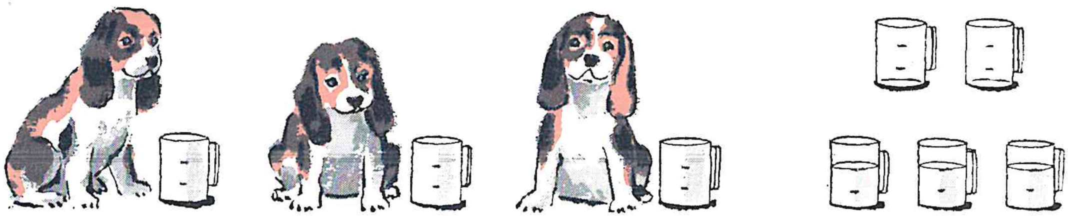
2. How much is each person's share of 4 candy bars if 3 people share equally? Tell why the answer is $1\frac{1}{3}$ candy bar.

$$\begin{array}{r} 1\frac{1}{3} \\ 3\overline{)4} \\ \underline{3} \\ 1 \end{array}$$

3. What is each one's share when Bill and Carl divide 5 apples equally?

4. Frank has 5 cups of milk for three puppies. How much is each one's equal share? Frank first divides. He gets $1\frac{2}{3}$ cups. Tell what happened in these pictures:

$$\begin{array}{r} 1\frac{2}{3} \\ 3\overline{)5} \\ \underline{3} \\ 2 \end{array}$$



What happened to the two cups that were left over? How much does each puppy get? $5 \div 3 =$ _?_

5. Divide. Write each remainder as a fraction in the quotient. The remainder is the numerator and the divisor is the denominator of the fraction.

a. $2\overline{)5}$ **b.** $2\overline{)4}$ **c.** $5\overline{)6}$ **d.** $3\overline{)5}$ **e.** $2\overline{)7}$

f. $3\overline{)7}$ **g.** $5\overline{)12}$ **h.** $4\overline{)5}$ **i.** $2\overline{)9}$ **j.** $4\overline{)7}$

▶ THINKING REMAINDERS IN TENS AND HUNDREDS (SHORT DIVISION)

$2\overline{)24}$

1. How many nuts will each boy get? Two boys are dividing 24 English walnuts equally. They divide the tens and then the ones.

$$\begin{array}{r} 16 \\ 2\overline{)32} \\ \underline{2} \\ 12 \end{array}$$

2. Could two boys divide 32 nuts the same way? This time there is 1 ten left over after the first division and its subtraction.

The 1 is a remainder in the tens' place. It is divided with the 2 ones.

$2\overline{)54}$

3. Martha says she can do examples like these "in her head." She writes only the answers. Tell how she "thinks" the remainder in tens' place.

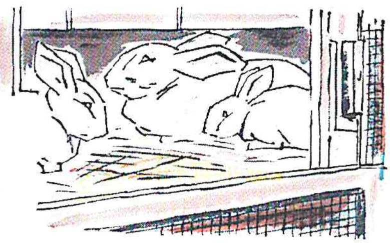
Martha's way is called **short division.**

Try these examples Martha's way:

a. $2\overline{)54}$	**b.** $4\overline{)96}$	**c.** $5\overline{)70}$	**d.** $3\overline{)87}$	**e.** $2\overline{)156}$
f. $5\overline{)365}$	**g.** $3\overline{)231}$	**h.** $4\overline{)172}$	**i.** $2\overline{)534}$	**j.** $4\overline{)936}$
k. $3\overline{)858}$	**l.** $5\overline{)2755}$	**m.** $2\overline{)1312}$	**n.** $4\overline{)1456}$	**o.** $3\overline{)2874}$

4. If you wish, you may write just the answers.

a. $2\overline{)486}$	**b.** $2\overline{)528}$	**c.** $2\overline{)734}$	**d.** $3\overline{)759}$	**e.** $3\overline{)816}$
f. $3\overline{)1569}$	**g.** $4\overline{)1296}$	**h.** $3\overline{)2478}$	**i.** $4\overline{)4328}$	**j.** $5\overline{)3575}$
k. $2\overline{)1360}$	**l.** $5\overline{)3150}$	**m.** $3\overline{)1920}$	**n.** $2\overline{)4960}$	**o.** $4\overline{)3840}$
p. $3\overline{)1605}$	**q.** $3\overline{)4404}$	**r.** $4\overline{)3308}$	**s.** $5\overline{)4305}$	**t.** $2\overline{)2608}$
u. $4\overline{)2416}$	**v.** $4\overline{)3276}$	**w.** $5\overline{)1045}$	**x.** $3\overline{)1827}$	**y.** $3\overline{)1236}$



LARGER REMAINDERS

1. Bill has 60 food pellets to feed 20 rabbits. How many pellets will each rabbit get?

a. If Bill feeds 10 more pellets, will each rabbit get another whole one? If he feeds 15 pellets?

Tell about the divisions below. How many of Bill's rabbits will get another pellet as Bill gets more pellets to feed them?

$$\begin{array}{r} 3 \\ 20\overline{)60} \\ \underline{60} \end{array} \qquad \begin{array}{r} 3 \\ 20\overline{)70} \\ \underline{60} \\ 10 \end{array} \qquad \begin{array}{r} 3 \\ 20\overline{)75} \\ \underline{60} \\ 15 \end{array} \qquad \begin{array}{r} 4 \\ 20\overline{)80} \\ \underline{80} \end{array}$$

b. Tell why the quotient digit changed from 3 to 4 in the divisions above.

2. Do you remember the rule on page 156? You try to divide the first digit of the dividend by the first digit of the divisor.

Write the quotient digit without the fraction:

a. $20\overline{)60}$	**b.** $30\overline{)90}$	**c.** $20\overline{)70}$	**d.** $40\overline{)90}$	**e.** $30\overline{)80}$
f. $30\overline{)50}$	**g.** $60\overline{)90}$	**h.** $40\overline{)70}$	**i.** $40\overline{)60}$	**j.** $70\overline{)90}$
k. $22\overline{)70}$	**l.** $25\overline{)78}$	**m.** $34\overline{)82}$	**n.** $43\overline{)90}$	**o.** $34\overline{)76}$

3. If the first digit of the divisor is larger than the first digit of the dividend, like this, $21\overline{)147}$, what do you do? See page 157, if you do not remember. Write the quotient digit for each of these without doing all of the example:

a. $20\overline{)160}$	**b.** $20\overline{)170}$	**c.** $30\overline{)150}$	**d.** $40\overline{)150}$
e. $50\overline{)160}$	**f.** $31\overline{)175}$	**g.** $42\overline{)236}$	**h.** $32\overline{)235}$

ESTIMATING QUOTIENTS

1. Thirty children had a picnic.

a. The children usually walk about a mile in 15 minutes. They left town at 10:45. They reached the picnic grounds at 11:15. About how many miles did they walk?

b. "Here are 75 weiners," said Ray. "There are 30 of us. Two 30's are 60. I think we can have $2\frac{1}{2}$ weiners apiece." Check Ray's estimate by division. Do you divide the *number* of weiners by the *number* of people?

c. Sally counted 45 cupcakes. About how many was that for each child? Check your estimate.

d. How many marshmallows were needed for 4 apiece?

2. For each example tell whether the first quotient digit will be in ones', tens', or hundreds' place:

a. $3\overline{)90}$ **b.** $30\overline{)90}$ **c.** $4\overline{)80}$ **d.** $40\overline{)80}$ **e.** $40\overline{)120}$

3. Which of these quotients will be largest? smallest?

a. $40\overline{)8000}$ **b.** $4\overline{)8000}$ **c.** $4000\overline{)8000}$ **d.** $400\overline{)8000}$

Estimate these answers. Choose the answer that is most nearly correct. Do the check marks help?

4. $6\overline{)1\overset{\surd}{2}\overset{\surd}{0}} = 20$ or 200

5. $3\overline{)\overset{\surd}{9}\overset{\surd}{6}\overset{\surd}{3}} = 30$ or 300

6. $5\overline{)1050} = 20$ or 200

7. $8\overline{)1605} = 200$ or 20

8. $2\overline{)2012} = 1000$ or 100

9. $70\overline{)7000} = 10$ or 100

10. $40\overline{)2004} = 50$ or 5

11. $90\overline{)9010} = 10$ or 100

12. $60\overline{)540} = 90$ or 9

13. $30\overline{)2701} = 90$ or 900

PRACTICE

Set 1

1. $20\overline{)80}$
2. $30\overline{)60}$
3. $22\overline{)66}$
4. $12\overline{)48}$
5. $32\overline{)64}$
6. $21\overline{)63}$
7. $42\overline{)84}$
8. $13\overline{)39}$
9. $34\overline{)68}$
10. $14\overline{)28}$
11. $21\overline{)189}$
12. $41\overline{)164}$
13. $62\overline{)124}$
14. $31\overline{)186}$
15. $71\overline{)355}$
16. $43\overline{)129}$
17. $52\overline{)104}$
18. $93\overline{)186}$
19. $51\overline{)255}$
20. $80\overline{)240}$

Set 2

1. $6\overline{)1926}$
2. $4\overline{)1852}$
3. $2\overline{)9046}$
4. $7\overline{)2891}$
5. $3\overline{)2952}$
6. $20\overline{)90}$
7. $50\overline{)60}$
8. $32\overline{)70}$
9. $44\overline{)91}$
10. $62\overline{)84}$
11. $50\overline{)210}$
12. $30\overline{)140}$
13. $73\overline{)300}$
14. $41\overline{)99}$
15. $91\overline{)290}$
16. $84\overline{)178}$
17. $46\overline{)239}$
18. $83\overline{)510}$
19. $65\overline{)398}$
20. $72\overline{)400}$

Set 3.

Write the remainders as fractions:

1. $5\overline{)31}$
2. $6\overline{)25}$
3. $9\overline{)29}$
4. $8\overline{)45}$
5. $7\overline{)59}$
6. $9\overline{)68}$
7. $8\overline{)71}$
8. $5\overline{)48}$
9. $7\overline{)40}$
10. $9\overline{)44}$
11. $4\overline{)31}$
12. $9\overline{)58}$
13. $7\overline{)45}$
14. $8\overline{)37}$
15. $5\overline{)43}$
16. $6\overline{)41}$
17. $4\overline{)27}$
18. $7\overline{)50}$
19. $8\overline{)61}$
20. $6\overline{)53}$

THE ANSWER STRIP

Use an answer strip as your teacher reads these number questions to you. (5 seconds each.)

Addition:

(1)	(6)	(11)	(16)	(21)
$8 + 6$	$4 + 8$	$8 + 9$	$4 + 6$	$9 + 8$
$3 + 7$	$6 + 7$	$3 + 5$	$5 + 9$	$6 + 5$
$6 + 2$	$9 + 3$	$9 + 7$	$8 + 7$	$7 + 9$
$5 + 7$	$8 + 5$	$8 + 3$	$6 + 3$	$6 + 8$
$6 + 9$	$4 + 7$	$7 + 8$	$5 + 8$	$4 + 9$

Multiplication:

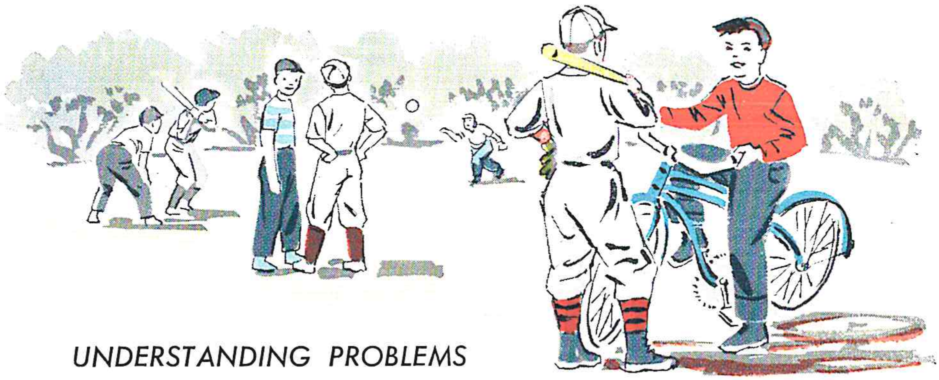
(1)	(6)	(11)	(16)	(21)
5×3	3×7	7×7	8×8	7×6
9×9	6×6	3×8	7×9	4×8
4×5	4×3	4×7	8×6	5×9
3×6	8×9	8×5	7×5	7×8
4×4	4×6	3×9	4×9	6×9

Subtraction:

(1)	(6)	(11)	(16)	(21)
$18 - 9$	$12 - 3$	$11 - 7$	$15 - 7$	$14 - 6$
$11 - 8$	$13 - 7$	$13 - 9$	$11 - 3$	$13 - 4$
$13 - 6$	$15 - 9$	$14 - 5$	$14 - 9$	$15 - 6$
$16 - 7$	$11 - 4$	$12 - 7$	$13 - 5$	$16 - 9$
$14 - 8$	$17 - 8$	$17 - 9$	$15 - 8$	$13 - 8$

Division. (Read, "How many 4's in 16?"; "3's in 18?")

(1)	(6)	(11)	(16)	(21)
$4\overline{)16}$	$5\overline{)30}$	$8\overline{)64}$	$7\overline{)63}$	$7\overline{)56}$
$3\overline{)18}$	$3\overline{)27}$	$7\overline{)35}$	$4\overline{)36}$	$6\overline{)42}$
$8\overline{)72}$	$4\overline{)24}$	$4\overline{)28}$	$7\overline{)42}$	$9\overline{)63}$
$6\overline{)36}$	$8\overline{)40}$	$8\overline{)48}$	$6\overline{)54}$	$8\overline{)56}$
$8\overline{)24}$	$5\overline{)45}$	$7\overline{)49}$	$4\overline{)32}$	$9\overline{)54}$



UNDERSTANDING PROBLEMS

1. How far will two round trips to the ball park be for Dave? His cyclometer shows that he lives $\frac{8}{10}$ mile from the park. Which is the most reasonable answer, 32 miles, $3\frac{2}{10}$ miles, or $\frac{32}{100}$ mile?

2. Barbara is buying 5 lb. of oranges at so many cents per pound. How can she find the total cost?

3. Jack is buying 4 toy cars. How can you tell how much change he should get from $1?

4. How much farther do you have to go? You know how far you have gone already. The answer depends on what?

5. A man has $200 to buy partly grown chickens. They will cost him 45¢ each. Do you estimate that he will get nearest 200, 300, 400, or 800 chickens?

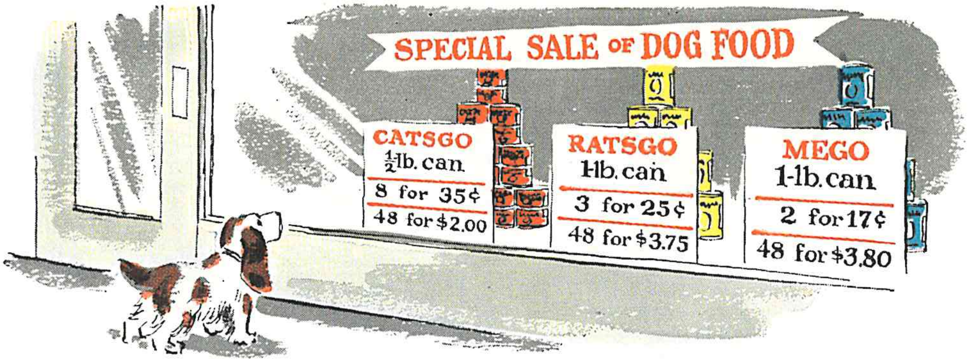
6. How do you find out how many yards there are in a mile if you know how many there are in $\frac{1}{4}$ mile?

7. How would you find the middle of a board that is 5 ft. 6 in. long? A drawing may help you.

8. What will this answer depend on? How much more money will Marie need to buy roller skates if she has $2.00 and earns $1.50 more?

9. How would you divide 3 qt. and 2 pt. of milk into two equal parts?

10. Write a problem about buying something you want and about how much more money you need.



BUYING WISELY FOR SPOT

1. Spot seems to be trying to save some money for Jim. Which kind of dog food is cheapest if Jim buys a case of 48 cans? Be careful. What do the cans weigh?

2. If 3 cans of Ratsgo dog food cost 25¢, how much will 48 cans cost if Jim buys 3 cans at a time?

How much cheaper is it to buy 48 cans at a time?

3. What does 1 can of Ratsgo cost at the 3-can rate? What does 1 can of Mego cost at the 2-can rate? What is the difference between the cost for 1 can of each kind?

4. What does 1 can of Catsgo cost at the 8-can rate? How many cans of Catsgo equal 1 can of Ratsgo? How much do 2 cans of Catsgo cost at the 8-can rate? Can you think of two ways to find this answer?

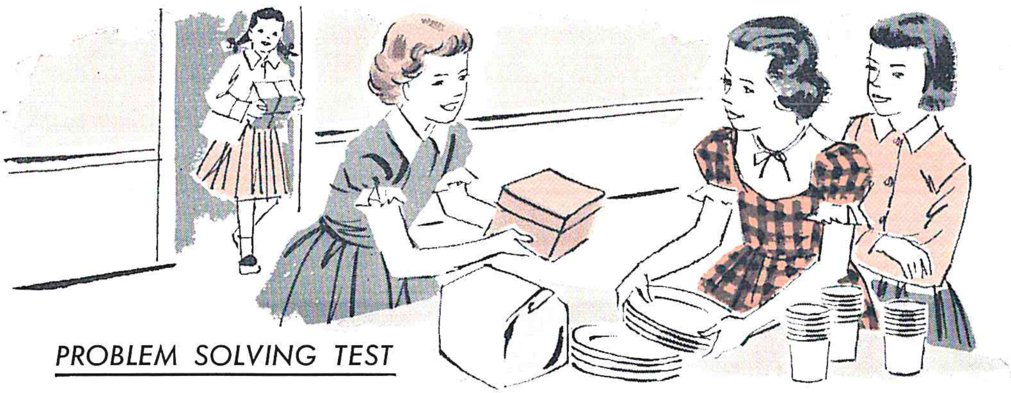
MAKING CHANGE

Do you remember how to count change? You give $1 to pay for a 39-cent toy. The clerk says "39, 40, 50, $1." What coins did he hand you?

Tell how you count change for these purchases:

1. 27¢ from $1	**4.** $1.43 from $5	**7.** $3.17 from $5
2. 70¢ from $1	**5.** $2.28 from $5	**8.** $5.62 from $10
3. 51¢ from $1	**6.** $3.07 from $5	**9.** $2.34 from $10

What 5 coins equal $1? What 11 coins equal 50¢?



PROBLEM SOLVING TEST

1. How much money did Susan collect for the party? She collected 14 quarters, 18 dimes, 16 nickels, and 10 cents.

2. How many sandwiches have both Bonnie and Patricia made? Bonnie says she has made 6. Patricia says she has made 4 more than Bonnie.

3. How far do you still have to go to get to camp? You were $3\frac{1}{2}$ miles from camp when you started. Your pedometer shows that you have already gone 2 miles.

4. Mrs. Thomas brought 5 dozen cookies for a party. How many cookies will be an equal share for each of 20 children?

5. How long will it be until the 1:15 P.M. train should arrive? It is now 11:30 A.M.

6. Larry is counting his money. How much should he have from his papers? They sell for 10¢ each. He had 20 to sell. He has 3 left.

7. What is the cost of $\frac{1}{4}$ lb. of lunch meat when it sells at 84¢ a pound?

8. What will be the total cost of 3 melons which sell for 3¢ a pound? The melons weigh 15 lb., 15 lb., and 20 lb.

9. What is the average number of books read by these five boys and girls? One read 4, another 6, another 3, another 0, and one read 7.

10. How many glasses of milk are there in a gallon if there are 2 glasses in a pint?

UNIT TEST

Set 1

Do these examples the short way.

1. $2\overline{)684}$	**4.** $6\overline{)186}$	**7.** $5\overline{)450}$	**10.** $5\overline{)2505}$
2. $3\overline{)936}$	**5.** $9\overline{)279}$	**8.** $3\overline{)186}$	**11.** $4\overline{)3288}$
3. $4\overline{)128}$	**6.** $7\overline{)420}$	**9.** $4\overline{)368}$	**12.** $2\overline{)4062}$

Set 2

Write the quotient digit for each example:

1. $20\overline{)60}$	**4.** $60\overline{)180}$	**7.** $70\overline{)350}$	**10.** $90\overline{)630}$
2. $30\overline{)90}$	**5.** $40\overline{)320}$	**8.** $60\overline{)420}$	**11.** $70\overline{)490}$
3. $50\overline{)150}$	**6.** $90\overline{)540}$	**9.** $80\overline{)560}$	**12.** $40\overline{)280}$

Set 3

Divide. Do not write the remainder as a fraction.

1. $21\overline{)63}$	**7.** $43\overline{)258}$	**13.** $32\overline{)96}$	**19.** $12\overline{)37}$
2. $33\overline{)66}$	**8.** $65\overline{)325}$	**14.** $21\overline{)86}$	**20.** $60\overline{)187}$
3. $42\overline{)126}$	**9.** $74\overline{)222}$	**15.** $43\overline{)92}$	**21.** $52\overline{)209}$
4. $62\overline{)186}$	**10.** $35\overline{)175}$	**16.** $12\overline{)29}$	**22.** $80\overline{)483}$
5. $84\overline{)252}$	**11.** $82\overline{)410}$	**17.** $25\overline{)78}$	**23.** $42\overline{)179}$
6. $95\overline{)285}$	**12.** $65\overline{)260}$	**18.** $31\overline{)99}$	**24.** $95\overline{)193}$

Jack says $\frac{2}{3}$ of the children in his room this year were also there last year. He says, too, that $\frac{2}{3}$ of the children are new this year. Can he be right? Why?

UNIT 12

HAVE YOU ANY TROUBLE SPOTS?

THE NUMBERS BELOW TELL THE PAGES TO TURN TO WHEN YOU NEED HELP.

THE MEANING OF NUMBERS

1. Write these numbers with digits: 72–76

a. Six thousand, thirty-two
b. Ten thousand, five hundred four
c. Two million, seventeen thousand, ninety-five

2. Which number has a 7 in tens' place?
17,853 1796 4872 97

3. Write the largest number you can by using the digits 4, 2, 8, 5, and 7 once each.

4. Write the largest 4-place number you can.

5. Write these numbers and put commas in the right places: 57032 9654738

6. Write the number that is a hundred more than 6472.

7. Write these numerals with digits: 70, 71

a. X **b.** V **c.** IX **d.** XIV **e.** XXIX **f.** XL

8. Copy the odd numbers in the row below: 51

6 5 27 14 58 43 332 465

9. What numbers come next? 49 56 63 _?_ _?_

10. One is related to 10 as 100 is related to _?_. 72

THE MEASURES

Write the answers on another paper:

1. 1 ft. = _?_ in.	**5.** 1 gal. = _?_ qt.	**9.** 1 lb. meat = _?_ oz.
2. 1 yd. = _?_ ft.	**6.** 1 qt. = _?_ pt.	**10.** 1 ton = _?_ lb.
3. 1 hr. = _?_ min.	**7.** 1 qt. = _?_ cups	**11.** 1 doz. = _?_ ones
4. $1 = _?_ dimes	**8.** 1 day = _?_ hr.	**12.** 1 yr. = _?_ mo.

Which of these measures is used most often when selling the things named in Examples 13–21?

weight *count* *gallon* *length*

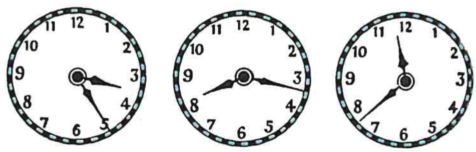
13. shoes	**16.** gasoline	**19.** books
14. sugar	**17.** toys	**20.** eggs
15. gum	**18.** ribbon	**21.** vegetables

Change Examples 22–31 to the unit asked for.
Sample: 3 ft. 4 in. = 40 in.

22. 1 hr. 20 min. = _?_ min.	**27.** 16 in. = _?_ ft. _?_ in.
23. 2 dollars 20 cents = _?_ ¢	**28.** 45 min. = _?_ hr.
24. 3 wk. 4 da. = _?_ da.	**29.** 20 oz. = _?_ lb. _?_ oz.
25. 2 lb. 8 oz. = _?_ lb.	**30.** 18 = _?_ doz.
26. 5 ft. 6 in. = _?_ in.	**31.** 16 ft. = _?_ yd. _?_ ft.

32. Tell the time of each clock to the nearest minute.

33. Could the month of this calendar be February, March, or April?



A B C

34. How many Thursdays are there in this month?

35. On what day is the 18th?

36. On what date does the first Monday come?

37. On what day does the month begin?

SUN	MON	TUE	WED	THU	FRI	SAT
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

ADDITION AND SUBTRACTION OF WHOLE NUMBERS

Set 1

4, 6, 12, 15, 16

Add and check:

1.	2.	3.	4.	5.
43	3736	626	$10.16	$14.29
86	8232	353	3.95	.73
	44	32	6.22	.26
		200	.67	73.84

6.	7.	8.	9.	10.
69	668	476	$ 6.55	$ 5.77
65	57	578	69.88	78.69
	969	799	62.79	3.47
		987	4.30	85.75

Set 2

8, 17–20

Subtract and check:

1.	2.	3.	4.	5.
$3.98	$5.84	$4.99	$8.70	$3.62
1.62	5.34	4.70	8.20	3.07

6.	7.	8.	9.	10.
1731	1282	1935	1424	1653
849	793	976	739	868

11.	12.	13.	14.	15.
635	116	800	690	305
540	86	407	654	240

16.	17.	18.	19.	20.
406	708	110	740	410
339	698	83	706	374

Set 3. Terms

6, 7

Which letter indicates a subtrahend? a remainder? a minuend? a difference? a sum? an addend? a total?

a.	125	d.	64
b.	−84	d.	38
c.	41	d.	92
		e.	194

MULTIPLICATION OF WHOLE NUMBERS

Set 1 38, 39

Multiply:

1. 32 × 3	2. 72 × 4	3. 23 × 4	4. 35 × 5	5. 69 × 3
6. 312 × 3	7. 348 × 2	8. 642 × 4	9. 537 × 7	10. 368 × 6
11. 340 × 2	12. 402 × 3	13. 502 × 6	14. 540 × 8	15. 460 × 9

Set 2 40, 41

Multiply:

1. 31 × 23	2. 82 × 34	3. 30 × 16	4. 132 × 32	5. 403 × 12
6. 274 × 60	7. 370 × 58	8. 306 × 79	9. 750 × 48	10. 800 × 53
11. 248 × 97	12. 369 × 68	13. 759 × 47	14. 584 × 56	15. 758 × 39

THE ANSWER STRIP. (Carry Facts)

Your teacher will read one question every 5 seconds.

(1)	(7)	(13)	(19)
48 and 3	16 and 6	72 and 8	54 and 7
64 and 6	63 and 8	36 and 3	27 and 8
56 and 7	32 and 6	27 and 6	25 and 3
24 and 3	48 and 5	45 and 7	49 and 4
45 and 6	54 and 8	56 and 5	35 and 5
49 and 5	49 and 6	48 and 7	28 and 6

DIVISION OF WHOLE NUMBERS

Set 1. Division

44–48

1. $2\overline{)8}$	**2.** $3\overline{)15}$	**3.** $2\overline{)64}$	**4.** $4\overline{)168}$
5. $4\overline{)80}$	**6.** $8\overline{)480}$	**7.** $3\overline{)960}$	**8.** $5\overline{)340}$
9. $9\overline{)38}$	**10.** $4\overline{)87}$	**11.** $3\overline{)78}$	**12.** $7\overline{)588}$
13. $9\overline{)612}$	**14.** $6\overline{)564}$	**15.** $9\overline{)671}$	**16.** $8\overline{)3979}$
17. $6\overline{)342}$	**18.** $7\overline{)525}$	**19.** $5\overline{)4535}$	**20.** $3\overline{)807}$

Set 2. Division

154–160

1. $20\overline{)80}$	**2.** $40\overline{)90}$	**3.** $30\overline{)180}$	**4.** $60\overline{)150}$
5. $23\overline{)92}$	**6.** $36\overline{)108}$	**7.** $52\overline{)221}$	**8.** $73\overline{)595}$
9. $82\overline{)499}$	**10.** $68\overline{)215}$	**11.** $97\overline{)792}$	**12.** $73\overline{)453}$
13. $95\overline{)387}$	**14.** $75\overline{)682}$	**15.** $86\overline{)607}$	**16.** $64\overline{)519}$

Set 3. Meaning in Division and Multiplication

80–88

1. Which example in the row below will have the largest quotient?

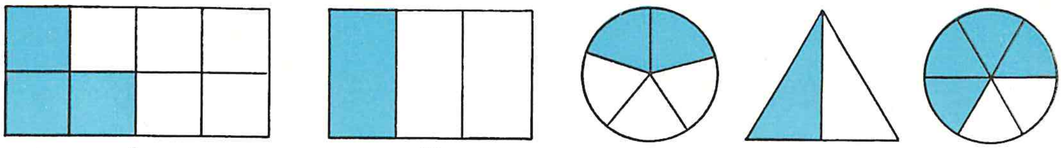
a. $87\overline{)4965}$ **b.** $87\overline{)4798}$ **c.** $87\overline{)4964}$ **d.** $87\overline{)4971}$

2. Which example in the row below will have the largest product?

a. 16×847 **b.** 16×846 **c.** 16×850 **d.** 16×849

3. Which number is the multiplier? the multiplicand? the product? the divisor? the dividend? the quotient?

$$\begin{array}{r}25\\ \underline{4}\\ 100\end{array} \qquad \begin{array}{r}9\\ 7\overline{)63}\end{array}$$



A B C D E

FRACTIONS

Set 1. Understanding Fractions

108–111

1. Which figure is $\frac{1}{2}$ colored? $\frac{2}{3}$ colored?
2. What part of Figure *A* is colored? of Figure *C*?
3. Which figure is more than half colored?
4. What part of each figure is not colored?
5. Which of these fractions is largest? smallest? 117

$\frac{1}{8}$ $\frac{1}{3}$ $\frac{3}{8}$ $\frac{1}{5}$ $\frac{1}{4}$ $\frac{2}{3}$

Set 2. Changing Fractions

Complete:

1. $\frac{1}{3} = \frac{?}{6}$ 2. $\frac{1}{2} = \frac{?}{8}$ 3. $\frac{2}{5} = \frac{?}{10}$ 4. $\frac{3}{4} = \frac{?}{8}$ 129

Change to lowest terms:

5. $\frac{2}{4}$ 6. $\frac{3}{12}$ 7. $\frac{4}{6}$ 8. $\frac{4}{10}$ 9. $\frac{6}{8}$ 132

Set 3. Addition

Change sums to lowest terms: 124–140

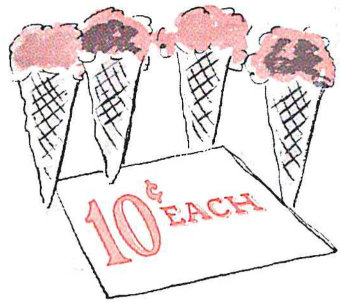
	a	b	c	d
1.	$\frac{1}{3} + \frac{1}{3}$	$\frac{1}{4} + \frac{1}{4}$	$\frac{1}{4} + \frac{1}{2}$	$\frac{1}{6} + \frac{2}{3}$
2.	$4 + 2\frac{1}{2}$	$\frac{1}{8} + 1$	$1\frac{2}{5} + \frac{2}{5}$	$\frac{2}{8} + 1\frac{1}{2}$
3.	$2\frac{1}{4} + 1\frac{2}{4}$	$3\frac{1}{8} + 2\frac{3}{8}$	$2\frac{1}{8} + 1\frac{1}{2}$	$1\frac{1}{2} + 3\frac{1}{6}$

Set 4. Subtraction

Change remainders to lowest terms:

	a	b	c	d
1.	$\frac{2}{3} - \frac{1}{3}$	$\frac{7}{8} - \frac{3}{8}$	$\frac{3}{4} - \frac{1}{2}$	$\frac{2}{3} - \frac{1}{6}$
2.	$2\frac{3}{5} - 1\frac{1}{5}$	$3\frac{3}{4} - 1\frac{1}{4}$	$3\frac{5}{8} - 2\frac{1}{4}$	$3\frac{5}{6} - 1\frac{1}{3}$
3.	$1\frac{4}{5} - \frac{2}{5}$	$4\frac{1}{4} - 1$	$3\frac{1}{8} - 1\frac{1}{8}$	$2\frac{2}{3} - 2$

UNDERSTANDING PROBLEMS



1. How do you find the total cost of several ice-cream cones?

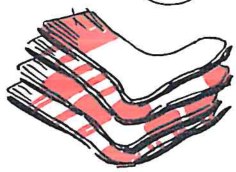
2. If you know how tall you were a year ago, how can you tell how much taller you have grown?

3. What does this answer depend on? How far did Bob ride his bicycle if his rate was 5 miles an hour?

4. Do you add, multiply, subtract, or divide? Jack wants to know how much each of 5 boys must pay to buy a baseball. The cost is $1.50.

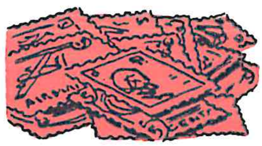
5. What questions must you answer?

Helen wants to know how much change she will get from $2. She is buying 4 pairs of bobby sox at 39¢ a pair.



6. George is earning $2 a day. How much has he earned so far? On what does the answer depend?

7. How do you find the average number of stamps that 4 boys have?



8. If you know what one box costs, how can you tell what ten boxes will cost, if each costs the same?

9. If you know how many rows of chairs there are in a classroom and how many there are in each row, how do you find the total number of chairs?

10. Write a problem about—

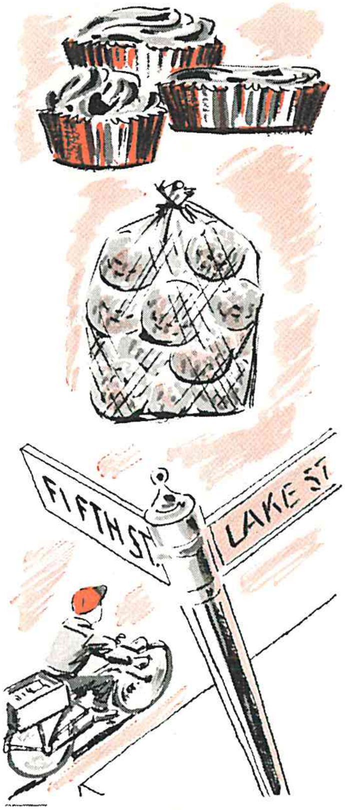
a. Something you want to buy and the money you already have.

b. How far you have ridden your bicycle today.

c. How much more money one person has than another person has.

d. Your share of the cost of a picnic.

SOLVING PROBLEMS



1. How many stamps will Joe have after he sells 36? He now has 125 stamps.

2. Martha can give 3 pieces of candy each to how many girls? She has 24 pieces to give away.

3. How many nickels can Jim change for 40 cents?

4. How many dozen oranges did Tom buy? He bought 3 dozen at 30¢ each and 2 dozen at 60¢ each.

5. What should Jane's change be? She gives a half dollar to pay for a 29-cent comb.

6. Harold says that when he reaches the corner of Fifth and Lake streets, he has already left 38 papers at homes and still has 27 to leave. How many homes does he serve on his paper route?

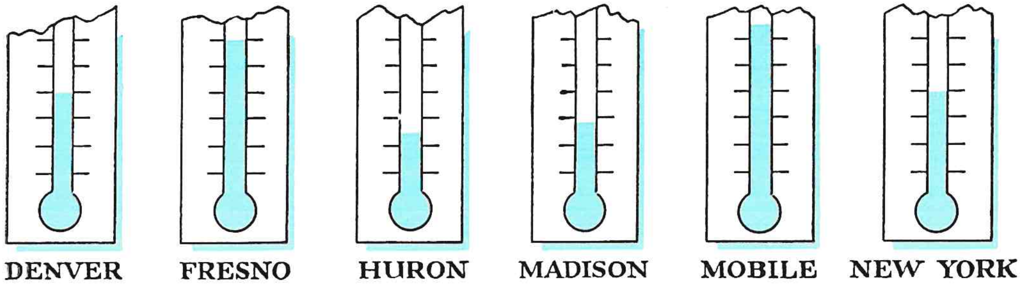
7. Barbara's mother baked 8 dozen cookies for the Campfire Girls. All but 25 were eaten. How many cookies did the girls eat?

8. Our family spent $130 for clothes and $75 for tires. How much more did we spend for clothes than for tires?

9. Our class sells popcorn at the ball games. It sells for 5¢ a sack. How many sacks must we sell to get $4?

10. Bill knows that he lives 90 miles from Bay City. He goes through Troy on his way to Bay City. His dad says it is 35 miles from Troy to Bay City. How far does Bill live from Troy?

11. What is each person's equal share to pay for a baseball. Seven will share the cost, which is $1.75.



UNIT 13

READING CHARTS GRAPHS, MAPS, TABLES

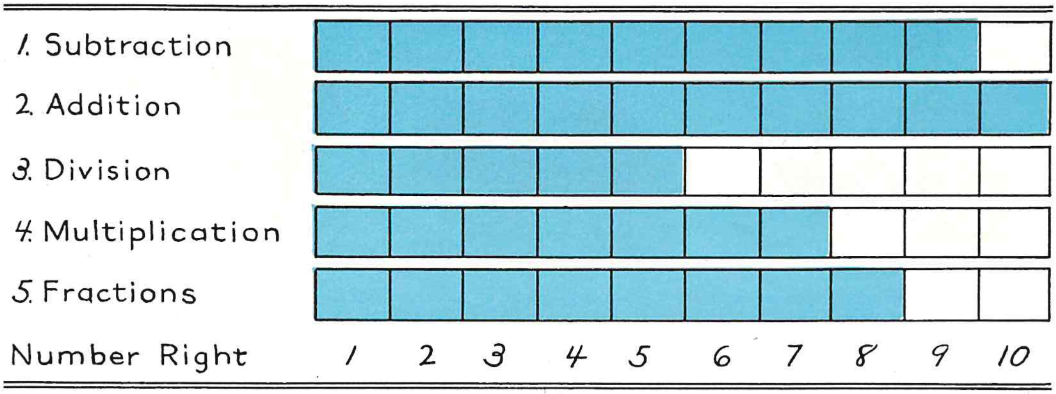
A CHART WITHOUT NUMBERS

Above are the bottom parts of six thermometers. They show temperatures in different places at the same time of the same winter day.

1. Which city is the coldest? warmest?
2. Which are the two coldest cities? two warmest?
3. Which two cities have the same temperature?
4. Is it colder in Madison or New York?
5. Is it warmer in Denver or Fresno?
6. How many cities are warmer than Madison?
7. How many cities are colder than Mobile?

You answered all these questions without numbers. You can make correct comparisons, but you cannot tell the differences between the temperatures in degrees without numbers. Many times you do not need to compare with numbers. Picture comparisons are close enough. On the next page we shall use numbers with pictures.

A chart gives information by using a picture, a map, a diagram, or some other kind of drawing.



CAROL'S SUCCESS CHART FOR ARITHMETIC

▶ READING A BAR GRAPH

Carol took five tests in arithmetic. Each test had 10 examples. Carol made a graph of her scores. Each space on this graph stands for one example. The number of correct examples is shown in color.

1. In which test did Carol do them all correctly?

2. In which test did she get fewest right?

3. Which test was second best?

4. Did she do better in multiplication or fractions?

The number of examples right is written at the bottom of the graph. To find the score for fractions, move your eyes to the last space of its colored bar. Then move down to the number straight below it. The number is 8. Carol got 8 examples right in fractions.

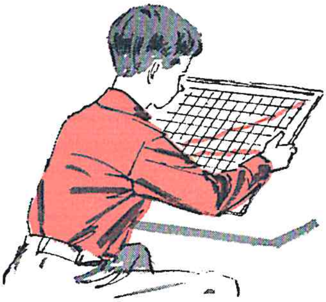
5. How many did Carol get right in multiplication? in division? in addition? in subtraction?

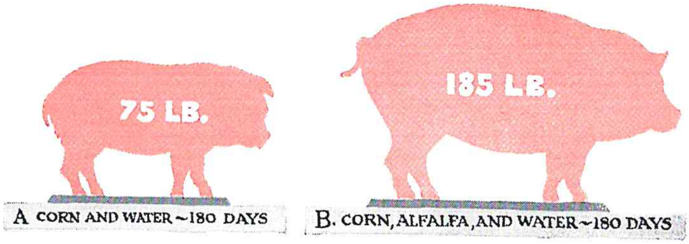
6. In which test did Carol get 7 right?

Find the 7. It means 7 right. Then look up for the bar that ends at 7. Is it multiplication?

7. In which test did Carol get 9 right? 5? 8?

8. Make a graph like Carol's showing 7 correct in subtraction, 9 in addition, 6 in division, 5 in multiplication, and 7 in fractions.





▶ READING PICTURE GRAPHS

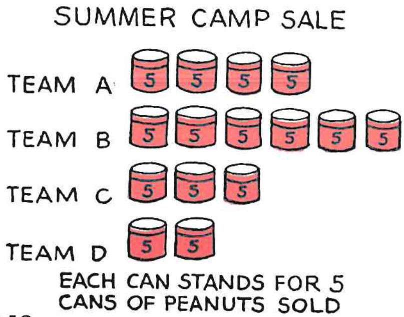
1. Frank is a 4-H Club member. He raises pigs. He found the graph above while he was reading how to feed his pigs. These two pigs are brothers and are the same age. One was fed only corn and water in a dry pen for 180 days. The other was kept in an alfalfa field for 180 days and had alfalfa with corn and water.

a. Which diet was better for a pig's growth?

b. How much more than the other did one gain?

c. Does the graph tell which one ate more corn?

2. Four teams of girls are selling cans of peanuts to earn money for summer camp. What does each of the cans in the graph stand for?



a. How many cans of peanuts has Team *A* sold? First you read what the figure after Team *A* means. In this graph each can means *5 cans sold*. You can count 5, 10, 15, 20, or you can multiply by 4. Team *A* has sold _?_ cans.

b. How many has Team *D* sold?

c. Has Team *B* sold more than 10? as many as 20?

d. How many cans have all the teams sold?

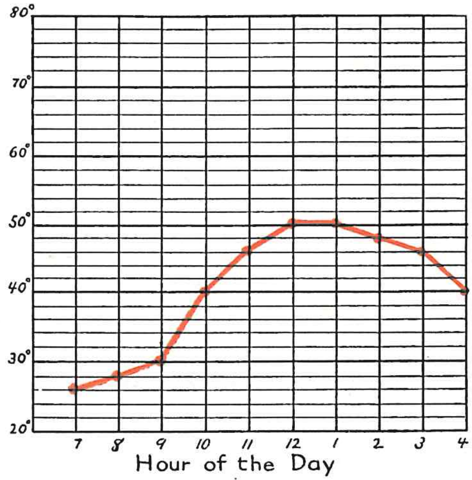
e. One team has sold more than Team *C* and *D* together. Which team is it?

READING A LINE GRAPH

The class is learning about temperature and about graphs. One day John read the temperature each hour, and showed his readings on this graph.

The sign (°) means **degree** or **degrees.**

TEMPERATURE READINGS



1. What was the temperature at 12 o'clock? at 1? at 4?

First, you find the hour where it says, "Hour of the Day." Then you follow the line straight up to where the temperature line crosses it.

From that point, you move left to John's thermometer scale and read the temperature. At 12 o'clock it was 50°. At 1 o'clock it was still 50°. At 4 o'clock it was 40°.

2. What was the temperature at 7 o'clock? Read carefully. Find 7. Go up to where the line crosses the temperature line. Then go left to John's scale. The temperature line is 3 spaces above 20. How many degrees is one space on most thermometers? How many on John's chart? John says it was 26° at 7 o'clock. Is he right?

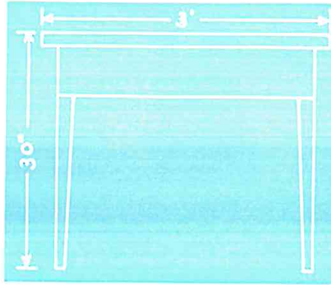
3. Was it warmer at 10 o'clock or 2 o'clock? at 11 o'clock or 4 o'clock? at 9 o'clock or 4 o'clock?

4. Do you think water froze into ice during the night before John made this chart?

5. Nearest what hours does John's chart show the temperature at freezing point? (Freezing point is 32° F.)

6. Is the temperature where you are right now higher or lower than this graph shows at the same hour?

READING DRAWINGS

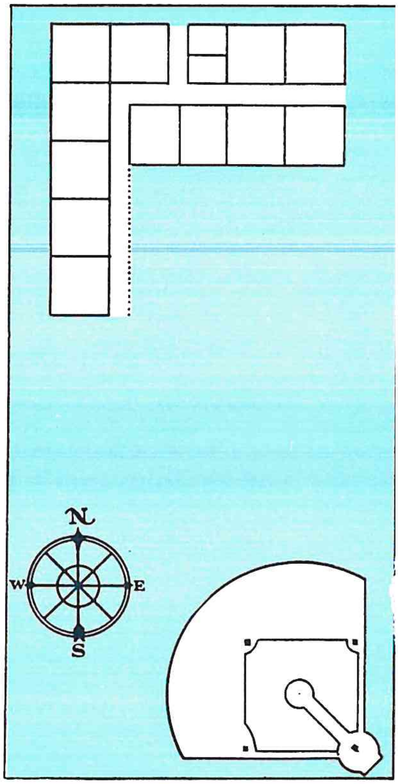


1. Peg's father is going to make this table for her room at home. What are the dimensions of the table?

Dimensions means measurements such as length, width, height, and thickness. The mark (′) means foot or feet, and (″) means inch or inches. 3′ means 3 ft., and 30″ means 30 inches.

How high will the table be? How long? Does the drawing show the width of the table?

2. The children in Peg's class drew this map of their school and playground. The scale says 1 in. = 100 ft. This means that 1 in. on the map stands for 100 ft. of playground. How long is the real playground? How wide? Find out by measuring the map with a ruler.



3. How long is the building? Are both wings the same length? the same width?

4. How many feet is $\frac{1}{2}$ in. on this drawing?

5. Is most of the playground south or north of the building?

6. In which corner is the ball diamond?

7. Can you find the two small rooms that look like the principal's office and the nurse's room?

How many other rooms are there?

Scale:
1 in. = 100 ft.

READING A TABLE

	JIM	BOB	TOM	JOE
1st	1.10	.70	.60	1.40
2nd	.70	1.20	1.10	1.20
3rd	.80	.60	.60	.60
4th	1.00	.90	.60	1.10
5th	.90	1.00	.40	.90

Money Earned in Five Weeks by Four Boys

Four boys kept a record of the money they earned for five weeks.

1. How much did Tom earn the 1st week? 3rd? 5th?

Tom's earnings are all listed under his name. You find the week that you want to know about. Then you move to Tom's column and read the amount.

2. Who earned most during the 2nd week? 4th week?

3. Which week was Jim's best week for earning money? Bob's? Tom's? Joe's?

4. Estimate the poorest week for all the boys together.

5. How can you tell that the total for the 5th week is larger than the total for the 3rd week without adding the amounts?

6. Without adding, estimate which boy earned the smallest total.

7. Which week did Bob earn 90¢?

8. How much did Joe earn the 5th week?

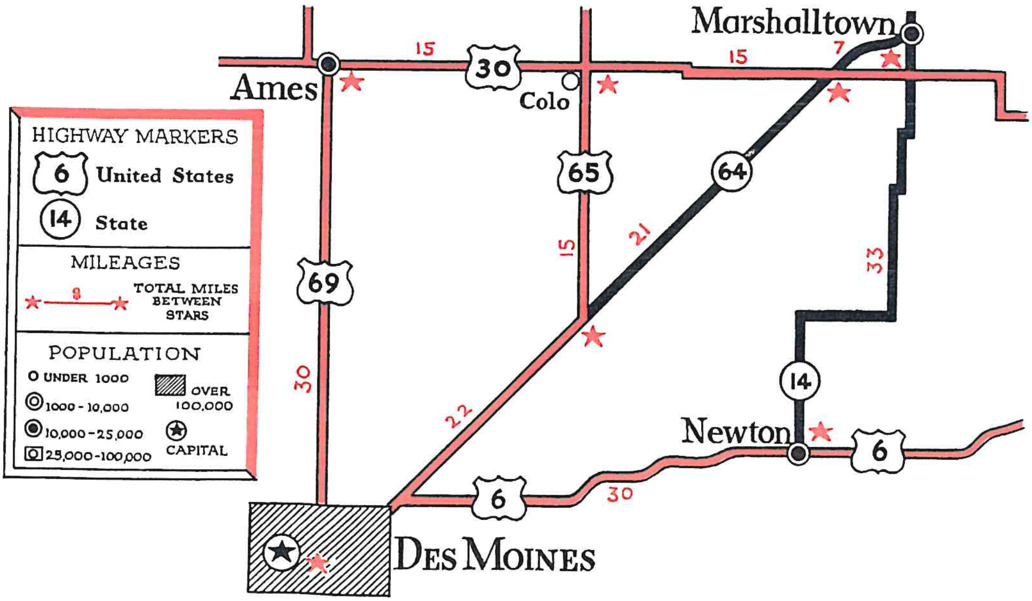
9. What was the most that anyone earned in any week?

10. In the second week, how much more did Joe earn than Tom?

11. Which boy earned 60¢ for three different weeks?

12. Which week did three boys earn 60¢ each?

13. What was the average amount earned weekly by Jim? by Bob? by Tom? by Joe? How much did the boys average for the 2nd week? the 3rd week? the 5th week?



NUMBERS ON A ROAD MAP

1. How many miles is it from Des Moines to Ames? Ames to Colo? Des Moines to Newton? Newton to Marshalltown?

2. To find the distance from Des Moines to Marshalltown on Highway 64, you must add three numbers together. What are the numbers? What is the total mileage this way?

3. How far is it from Des Moines to Marshalltown if you go through Newton? through Ames?

4. You can go from Colo to Des Moines two ways. You can go on Highway 65, or you can start on Highway 30 and turn onto Highway 69. What is the difference in miles?

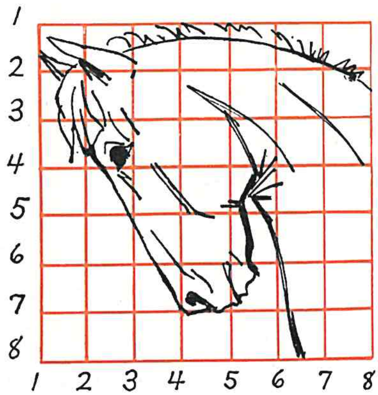
5. Look at the United States highway numbers. Are the numbers on east and west highways odd or even? Are the numbers on north and south highways odd or even? Is this a rule for marking United States highways?

6. Make up some problems of your own like Problem 4 above.

ENLARGING BY SQUARES

The boys are planning to cut plastic paperweights for their mothers. Don wants to use his drawing of a horse's head as a pattern. "But it's too small," he says.

Bill shows Don how to enlarge his picture by using squares.



FIRST. Measure and draw a square over your drawing. Divide it into squares that are $\frac{1}{4}$ inch on each side. Number the lines each way.

SECOND. On another paper, draw other squares. If you want your drawing twice as large, make your squares twice as large on each side. Number the lines like the ones in the picture.

THIRD. See where the lines of your first drawing are crossed by the numbered lines of the squares.

FOURTH. On the larger squares make dots where the lines of the drawing and the lines of the squares cross. Connect them with lines like those of the drawing.

1. The small drawing has $\frac{1}{4}$-inch squares. What size squares would Don need to make a drawing—

a. twice as large?
b. three times as large?
c. four times as large?
d. five times as large?

2. How could a drawing be made smaller?

3. Make a drawing you would like to make larger. Enlarge it by using squares.

PRACTICE

1. $78\overline{)3393}$ **2.** $64\overline{)5392}$ **3.** $86\overline{)6278}$ **4.** $97\overline{)3599}$

UNIT 14

DIVISION AND PROBLEM SOLVING

A PLANE RIDE

Kathy's father is an airplane pilot. He offered to take all the children in the 4th, 5th, and 6th grade rooms in Kathy's school for a ride over the city and the country nearby.

The plane holds 30 children. How many trips do you think Kathy's father would make to give all the children a ride? What other facts do you need to know?

1. There are 32 children in Kathy's room. If 30 go the first trip, how many will be left for the next trip?

$$\begin{array}{r} 1 \\ 30\overline{)32} \\ \underline{30} \\ 2 \end{array}$$

2. If it takes 10 trips for 300 children, how many trips would it take for twice as many? What is 2 times 300? $600 \div 30 = \underline{\ ?\ }$

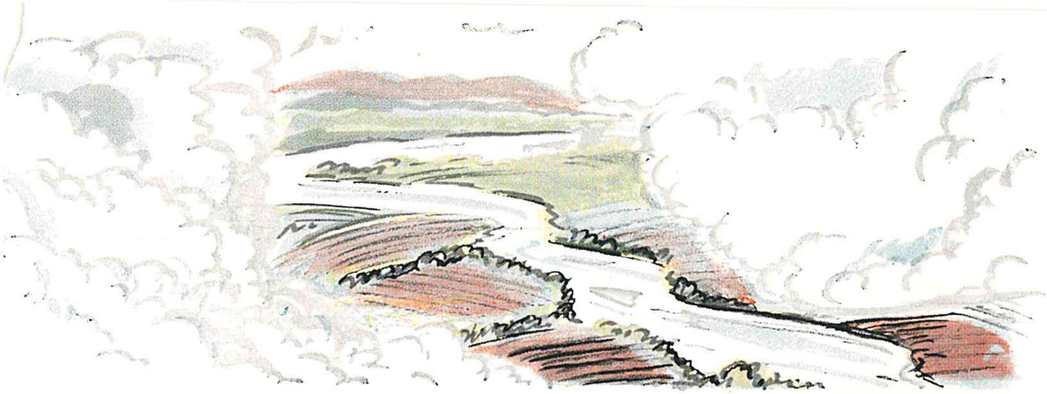
$$\begin{array}{r} 10 \\ 30\overline{)300} \\ \underline{30} \\ 0 \end{array}$$

3. If it takes 20 trips for 600 children, how many trips would be needed to take twice as many? $2 \times 600 = \underline{\ ?\ }$ $1200 \div 30 = \underline{\ ?\ }$

$$\begin{array}{r} 20 \\ 30\overline{)600} \\ \underline{60} \\ 0 \end{array}$$

Do you remember this dividend-divisor-quotient rule?

> When a number multiplies the dividend, it also multiplies the quotient if the divisor remains the same.



UNDERSTANDING TWO-DIGIT QUOTIENTS

```
     6
30)180
   180
```

```
     12
30)360
   30
    60
    60
```

1. How many plane trips with 30 children in each plane will be needed for 180 children?

If you double the number of children, what happens to the number of trips needed? How many thirties are there in 360?

2. Dick says, "We can do division by subtraction. I can save time by subtracting 30 ten times at once. $10 \times 30 = 300$. Then I can subtract 30 two times. I have subtracted 30 twelve times. There are 12 thirties in 360.

```
360
300   10 thirties
 60
 60    2 thirties
      12 thirties
```

3. Kathy uses the dividend to keep the place value. Dick writes all the zeros.

A. *Kathy*

```
     42
20)840
   80
    40
    40
```

Kathy says
80 tens means
800

Dick

```
     42
20)840
   800
    40
    40
```

Dick writes
800

B. *Kathy*

```
     23
30)690
   60
    90
    90
```

Kathy says
60 tens means
600

Dick

```
     23
30)690
   600
    90
    90
```

Dick writes
600

STEPS WITH TWO-DIGIT DIVISORS AND TWO-DIGIT QUOTIENTS

Tell what happened in each of these divisions. Look to see how many tens were taken out first. Then see how many tens and how many ones remained.

a

$$\begin{array}{r} 32 \\ 11\overline{)352} \\ 33 \\ \hline 22 \\ 22 \\ \hline \end{array}$$

b

$$\begin{array}{r} 21 \\ 14\overline{)294} \\ 28 \\ \hline 14 \\ 14 \\ \hline \end{array}$$

c

$$\begin{array}{r} 36 \\ 50\overline{)1800} \\ 150 \\ \hline 300 \\ 300 \\ \hline \end{array}$$

d

$$\begin{array}{r} 23 \\ 42\overline{)966} \\ 84 \\ \hline 126 \\ 126 \\ \hline \end{array}$$

Divisions like those above can be done by these six steps:

$$21\overline{)714}$$

1. Select the partial dividend. 21 is larger than 7, so 71 is used for the first division.

$$21\overline{)714}$$

2. Divide the 7 by the 2 to get the first quotient digit.

3. The 71 means 71 tens, so place the quotient in tens' place.

$$\begin{array}{r} 3 \\ 21\overline{)714} \\ 63 \\ \hline 8 \end{array}$$

4. Multiply and *compare.* $3 \times 21 = 63$ Is 63 no larger than 71?

5. Subtract 63 tens from 71 tens. *Compare.* The difference must be smaller than the divisor. Is 8 less than 21?

$$\begin{array}{r} 3 \\ 21\overline{)714} \\ 63 \\ \hline 84 \end{array}$$

6. 8 tens and 4 ones remain to be divided. *Bring down* the 4 ones to make a new dividend. Now do the same steps, excepting No. 1:

Divide 8 by 2 to get the quotient digit.
Place the quotient digit in ones' place.
Multiply 4×21 and compare.
Subtract and compare.
There is no more left to bring down.

$$\begin{array}{r} 34 \\ 21\overline{)714} \\ 63 \\ \hline 84 \\ 84 \\ \hline \end{array}$$

PRACTICE

Use these steps as you work the examples below:

a. Select the partial dividend.
b. Divide to get the quotient digit.
c. Find the quotient place.
d. Multiply and compare.
e. Subtract and compare.
f. Bring down the next digit.

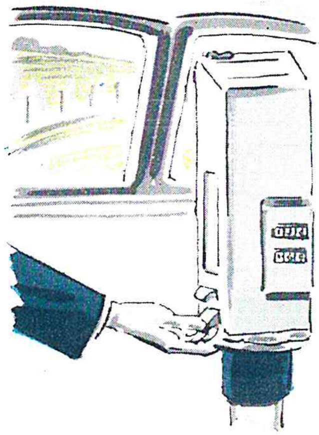
Set 1

	a	b	c	d
1.	40)840	20)680	50)1750	60)1500
2.	31)992	23)506	12)396	14)294
3.	32)672	11)495	23)782	35)770
4.	24)576	46)966	32)768	25)575
5.	42)1344	64)2880	56)3472	83)4399
6.	34)1496	72)4608	93)6975	74)4144
7.	52)3848	82)5166	65)4745	94)6016

Set 2

	a	b	c	d
1.	30)630	20)860	40)840	30)990
2.	60)1440	50)1850	21)903	42)966
3.	32)768	22)946	24)792	31)713
4.	32)832	41)984	24)768	33)891
5.	12)288	23)782	63)1449	42)1932
6.	32)1728	56)1960	74)1776	35)1470
7.	54)3996	75)4800	96)6912	84)6384

DIFFERENT WAYS TO SOLVE PROBLEMS



1. Mr. Roberts checks his counter at the end of each run. This morning he had 3 runs. He said he had 92 passengers on the first run, 88 on the second, and 125 on the third run. Of course, not all the passengers were on the bus at one time. How much money should he have if each passenger paid 13¢? Try these steps to solve the problem:

a. The question: How much money all together?
b. Estimate: About 300 times 13¢ is nearly $40.
c. Write the numbers to be used:

Gary's Layout
92 + 88 + 125   × 13¢

Sue's Layout
92 × 13¢   88 × 13¢   125 × 13¢

d. Work the example. (Finish both ways.)

Gary added, then multiplied.	Sue multiplied, then added.		
$\begin{array}{r} 305 \\ \times 13 \\ \hline \end{array}$	$\begin{array}{r} 92 \\ \times 13 \\ \hline \end{array}$	$\begin{array}{r} 88 \\ \times 13 \\ \hline \end{array}$	$\begin{array}{r} 125 \\ \times 13 \\ \hline \end{array}$

e. Is the answer close to your estimate?

2. In the afternoon Mr. Roberts has 3 runs. The numbers of passengers today were 95, 106, and 134. How much money should he have at 13¢ each?

● Steps that help some people solve problems: **a.** Read, and find the question. **b.** Estimate the answer. **c.** Lay out the numbers. **d.** Work the example. **e.** Is the answer reasonable?

TWO TOKENS FOR A QUARTER

1. Suppose all of Mr. Roberts' passengers pay 25¢ for two bus fare tokens. How much money will the bus company get for 324 tokens?

The question: How much money all together?

Estimate: Sue estimated over 300 at more than 10¢ each. That's over $30, maybe $40.

An unseen question: How many 2's in 324?

Lay out the numbers: Work the example:

Sue's layout
25¢ for 2
2's in 324 =

Sue's work

$$\begin{array}{r} 162 \\ \underline{25} \\ 810 \\ \underline{324} \\ 4050 \end{array} = \$40.50$$

Is the answer reasonable? Is $40.50 close to Sue's estimate of "maybe $40"?

2. At 3 o'clock the buses carry school children. The bus capacity is 36 children. How many buses will it take for 144 children?

3. One week Mr. Roberts made 42 runs. His total number of passengers was 3024. How many passengers did he average per run?

4. One week Mr. Roberts made 32 runs with 2688 passengers. The next week he had 42 runs and 3444 passengers. In which week did his runs average more passengers?

5. How many tokens can you buy for $3.00 if 2 cost 25¢? How much would the same number of rides cost at 13¢ each? What is the difference for this number of rides?

6. In one city, rides are 10¢ each. Tokens are 3 for 25¢.

a. How much do 24 tokens cost?

b. How much do 24 rides cost at 10¢ each?

c. How much do you save on 24 rides by buying tokens?

ROUND NUMBERS

1. Doris measures 4 ft. $10\frac{1}{2}$ in. tall. She is nearly _?_ ft.

2. John has $4.95. He has about _?_ dollars.

3. The meat weighs $15\frac{1}{2}$ ounces. That is about _?_ pound.

4. Bill was gone 59 days. That is about _?_ months.

5. There are 198 books in our room. That is about _?_ hundred books.

6. Is 56 nearer 50 or 60?

7. Is 78 nearer 70 or 80?

8. Is 93 nearer 90 or 100?

9. 103 is a little over _?_.

10. 25 is about _?_ dozen.

11. 38 in. is about _?_ yd.

You may round a whole number by giving the nearest ten or hundred.

12. Round each number to the nearest ten:

48 61 84 31 67 142 169 56

13. Round each number to the nearest hundred:

630 988 726 1895 1282 1617

A round measure is the closest number of a larger unit of measure. Inches are rounded to feet, minutes to hours, and cents to dollars.

14. Round each measure to the next larger unit of measure. *Example:* 23 in. is about 2 ft., but 15 in. is nearer 1 ft.

13 oz. 8 ft. 13 qt. 65 min.

15. Ellen has $1.75 in quarters and 11 dimes. About how many dollars has she?

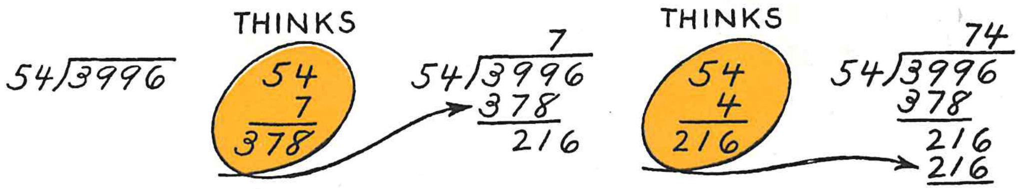
16. Joe has 24 dimes. Round to the nearest half dollar.

17. Frank's mother wants a new chair that costs $42.50. Round to the nearest $10.

18. Why do merchants often price their goods as shown on these price tags?

▶ CARRYING IN YOUR HEAD WHEN YOU MULTIPLY IN DIVISION

When Gloria divides, she must do parts of the process in her head. See below what she writes and thinks:



Follow these steps when you multiply in division:

a. Multiply the ones' digit.
b. Write ones' product.
c. Think the carry number.
d. Multiply the tens' digit.
e. Add carry number.
f. Write tens' product.

Lay out an answer sheet with numbers and letters just the way the examples below are placed on the page.

Write the answers for the multiplications as if you were dividing. Do not write anything but the products.

	a	b	c	d	e	f
1.	$\begin{array}{r} 4 \\ 24\overline{)\quad} \\ \underline{?} \end{array}$	$\begin{array}{r} 6 \\ 35\overline{)\quad} \\ \underline{?} \end{array}$	$\begin{array}{r} 9 \\ 52\overline{)\quad} \\ \underline{?} \end{array}$	$\begin{array}{r} 7 \\ 53\overline{)\quad} \\ \underline{?} \end{array}$	$\begin{array}{r} 5 \\ 24\overline{)\quad} \\ \underline{?} \end{array}$	$\begin{array}{r} 8 \\ 35\overline{)\quad} \\ \underline{?} \end{array}$
2.	$\begin{array}{r} 6 \\ 72\overline{)\quad} \\ \underline{?} \end{array}$	$\begin{array}{r} 8 \\ 29\overline{)\quad} \\ \underline{?} \end{array}$	$\begin{array}{r} 4 \\ 58\overline{)\quad} \\ \underline{?} \end{array}$	$\begin{array}{r} 9 \\ 37\overline{)\quad} \\ \underline{?} \end{array}$	$\begin{array}{r} 7 \\ 28\overline{)\quad} \\ \underline{?} \end{array}$	$\begin{array}{r} 3 \\ 68\overline{)\quad} \\ \underline{?} \end{array}$
3.	$\begin{array}{r} 9 \\ 69\overline{)\quad} \\ \underline{?} \end{array}$	$\begin{array}{r} 4 \\ 36\overline{)\quad} \\ \underline{?} \end{array}$	$\begin{array}{r} 6 \\ 68\overline{)\quad} \\ \underline{?} \end{array}$	$\begin{array}{r} 8 \\ 47\overline{)\quad} \\ \underline{?} \end{array}$	$\begin{array}{r} 5 \\ 47\overline{)\quad} \\ \underline{?} \end{array}$	$\begin{array}{r} 7 \\ 49\overline{)\quad} \\ \underline{?} \end{array}$
4.	$\begin{array}{r} 8 \\ 68\overline{)\quad} \\ \underline{?} \end{array}$	$\begin{array}{r} 6 \\ 49\overline{)\quad} \\ \underline{?} \end{array}$	$\begin{array}{r} 7 \\ 67\overline{)\quad} \\ \underline{?} \end{array}$	$\begin{array}{r} 4 \\ 79\overline{)\quad} \\ \underline{?} \end{array}$	$\begin{array}{r} 3 \\ 97\overline{)\quad} \\ \underline{?} \end{array}$	$\begin{array}{r} 9 \\ 48\overline{)\quad} \\ \underline{?} \end{array}$

PROBLEMS WITH REMAINDERS

A carpenter was building new shelves in the school storeroom. "Why," asked Tom, "do we need new shelves when so many are empty now?" Mr. Gray, the principal, gave him these problems:

1. There are 500 arithmetic books being used by children now. Each shelf will hold about 40. How many shelves are needed to store arithmetic books in the summer?

Tom divided 500 by 40. It will take 12 shelves and room for 20 more books. How much of a shelf is needed for 20 arithmetics?

$$\begin{array}{r} 12 \\ 40\overline{)500} \\ 40 \\ \hline 100 \\ 80 \\ \hline 20 \end{array}$$

2. "There are about 350 dictionaries to be stored," said Mr. Gray. "Each shelf will hold about 30."

What did Tom divide this time? Does your work show 11 shelves and 20 books left over?

Will 20 dictionaries and 20 arithmetics fit in one shelf?

3. Find the shelf space needed for each of these:

a. 950 readers at about 40 per shelf.

b. 275 geographies at about 40 per shelf.

c. 500 spellers at about 80 per shelf.

d. 375 histories at about 30 per shelf.

Which part of a shelf is larger, $\frac{20}{30}$ or $\frac{20}{40}$?

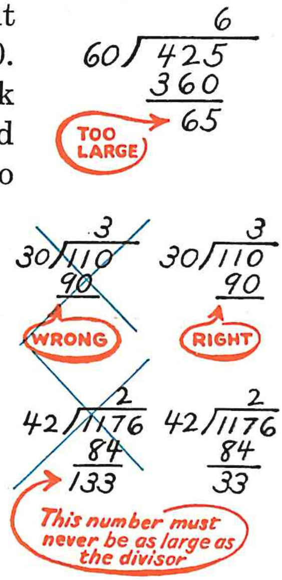
WATCH THE SIZE OF REMAINDERS

1. There are 425 primary readers. About 60 will go on a shelf. Tom divided 425 by 60. He thought of $6 \times 6 = 36$, but he did not think of $6 \times 7 = 42$. His answer was 6 shelves and 65 books on another shelf. Will Tom need to do this example again? Why?

2. Doris divided 110 by 30. She was troubled because of subtraction. She put the 90 in the wrong position.

3. Jim learned to watch the remainder each time. It *should never be as large as the divisor.* What mistake did Jim make?

4. Compare before you subtract, too. *The subtrahend should never be larger than the minuend.*



> Each time you subtract in division, the subtrahend must not be larger than the minuend. Each remainder must be smaller than the divisor.

Copy and divide:

	a	b	c	d	e
5.	20)650	30)950	20)875	40)865	30)675
6.	22)792	31)885	42)977	21)976	20)827
7.	32)775	33)895	44)975	35)875	24)799
8.	34)879	43)751	23)999	34)1781	73)6299
9.	62)2695	83)5490	92)5987	54)4975	63)5355
10.	95)7125	74)3996	64)4672	82)7954	75)4800

MULTIPLYING AND DIVIDING ARE OPPOSITES

Mr. Gordon is thinking about setting out strawberry plants. He made two problems for Harold and Ruth.

HAROLD'S PROBLEM: How many dozens are 276 plants?
RUTH'S PROBLEM: How many are 23 dozen?

HAROLD'S DIVISION	RUTH'S MULTIPLICATION
$\begin{array}{r} 23 \\ 12\overline{)276} \\ \underline{24} \\ 36 \\ \underline{36} \end{array}$	$\begin{array}{r} 12 \\ \underline{23} \\ 36 \\ \underline{24} \\ 276 \end{array}$

DIVIDEND	276	PRODUCT
DIVISOR	12	MULTIPLICAND
QUOTIENT	23	MULTIPLIER
SUBTRAHENDS	24 tens 36 ones	PARTIAL PRODUCTS

In multiplication you multiply by ones first. You get 36. Then you add the 24 tens.

In division you subtract the 24 tens first. Then you take 36 ones.

Divide each of these. Then multiply the quotient by the divisor. Is the product the same as the dividend?

1. $94\overline{)1410}$	**2.** $82\overline{)2952}$	**3.** $63\overline{)1512}$	**4.** $76\overline{)2052}$
5. $65\overline{)1690}$	**6.** $54\overline{)1188}$	**7.** $86\overline{)2322}$	**8.** $92\overline{)3956}$
9. $73\overline{)2555}$	**10.** $96\overline{)2304}$	**11.** $85\overline{)2380}$	**12.** $74\overline{)3404}$

● If the *product* of the divisor and the quotient is the *dividend*, your work checks. If there is a remainder, add it to the product of the quotient by the divisor.

DO YOU CHECK ALL DIVISIONS?

1. Do you know why you add the remainder when you check uneven divisions?

Jack has 27 guinea pigs to put into 6 pens. How many will be in each pen?

Look at the division. There are 4 guinea pigs for each pen. What does the *3* mean? To be sure that all guinea pigs are accounted for, you must add the number left over.

DIVIDE	CHECK
$\begin{array}{r} 4 \\ 6\overline{)27} \\ \underline{24} \\ 3 \end{array}$	$\begin{array}{r} 4 \\ \underline{\times 6} \\ 24 \\ \underline{3} \\ 27 \end{array}$

2. Tell how to check each of these divisions:

a. $\begin{array}{r} 6 \\ 5\overline{)34} \\ \underline{30} \\ 4 \end{array}$ **b.** $\begin{array}{r} 5 \\ 7\overline{)41} \\ \underline{35} \\ 6 \end{array}$ **c.** $\begin{array}{r} 18 \\ 4\overline{)75} \\ \underline{4} \\ 35 \\ \underline{32} \\ 3 \end{array}$ **d.** $\begin{array}{r} 12 \\ 8\overline{)102} \\ \underline{8} \\ 22 \\ \underline{16} \\ 6 \end{array}$ **e.** $\begin{array}{r} 45 \\ 3\overline{)137} \\ \underline{12} \\ 17 \\ \underline{15} \\ 2 \end{array}$

PRACTICE

Set 1

Copy, divide, and check:

1. $6\overline{)99}$ **2.** $8\overline{)197}$ **3.** $9\overline{)130}$ **4.** $5\overline{)287}$ **5.** $7\overline{)150}$

6. $4\overline{)97}$ **7.** $3\overline{)173}$ **8.** $8\overline{)256}$ **9.** $7\overline{)171}$ **10.** $9\overline{)225}$

11. $7\overline{)327}$ **12.** $8\overline{)362}$ **13.** $5\overline{)231}$ **14.** $9\overline{)308}$ **15.** $3\overline{)209}$

16. $4\overline{)219}$ **17.** $7\overline{)343}$ **18.** $9\overline{)411}$ **19.** $6\overline{)215}$ **20.** $8\overline{)423}$

Set 2

Copy, divide, and check:

1. $34\overline{)413}$ **2.** $23\overline{)500}$ **3.** $51\overline{)2630}$ **4.** $42\overline{)1150}$

5. $50\overline{)607}$ **6.** $60\overline{)1209}$ **7.** $68\overline{)3413}$ **8.** $22\overline{)917}$

9. $11\overline{)798}$ **10.** $38\overline{)1151}$ **11.** $74\overline{)5923}$ **12.** $95\overline{)6948}$

SACAGAWEA, THE "BIRD WOMAN"

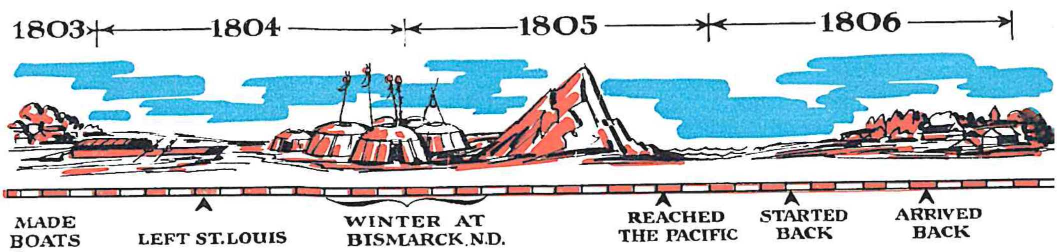
When only the Indians lived in the Northwest, Lewis and Clark led a group of men to explore it. They started from St. Louis, went up the river, then over the Rocky Mountains, and down to the Pacific Ocean. Sacagawea (sah kah′gah way′ah), a young Indian woman guide, and her husband traveled with them from North Dakota to the ocean. She got horses and other help for them from the friendly Indians along the way. The name, Sacagawea, means "bird woman."

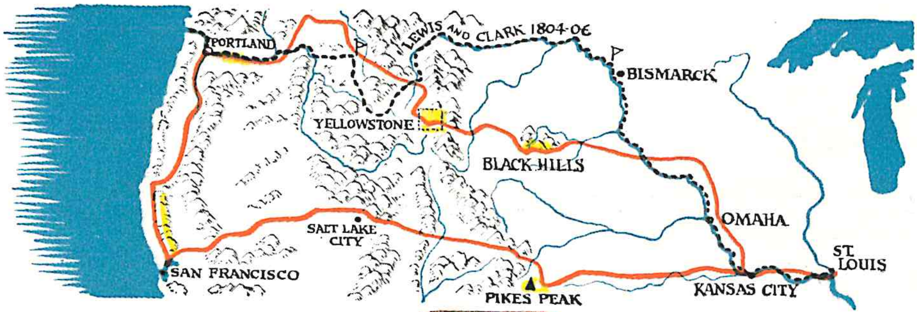
1. The party started with 2 leaders, 4 sergeants and 23 privates of the United States Army, 3 interpreters, and several servants. How many started, in addition to the servants?

2. The group left St. Louis in May, 1804. They spent the winter in North Dakota and reached the ocean in 1805. They arrived back in St. Louis on September 23, 1806. About how long were they gone?

3. Read the time line of the trip below:

- **a.** About how long did it take to go? to come back?
- **b.** Where were they in January, 1805? in January, 1806?
- **c.** In about what month did they reach the Pacific?
- **d.** About how long did they stay at the ocean?
- **e.** Where did they probably spend the winter of 1803–4?





THE GREAT NORTHWEST

Tom and his family are planning a 3-week trip to the Pacific Northwest.

1. They will leave on July 6. What date will they return?

2. The trip will be about 2200 miles each way. They plan to go in 11 days and return in 10 days. About how many miles must they average daily while going? while returning?

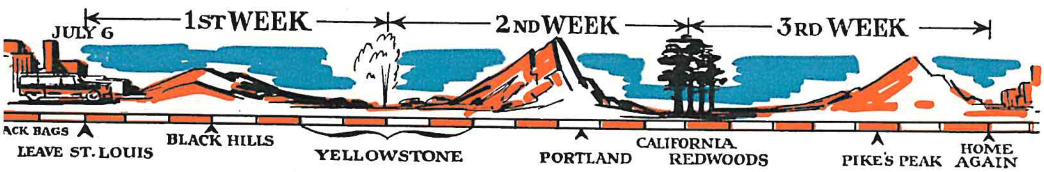
3. If they average 200 miles daily, how many days will they need for all of the trip?

4. Tom has made a log of the trip.

a. On about what dates will they be in Yellowstone?

b. On which date will they see the redwoods?

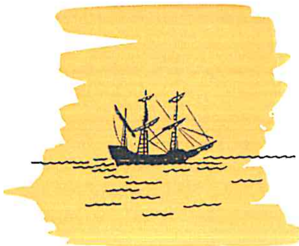
c. About when will they be at Pike's Peak?



5. Dad thinks they will average 20 mi. on a gallon of gasoline. How many gallons will 4400 mi. take? How much will the gasoline for their trip cost at 30¢ a gallon?

THE SHIPS OF COLUMBUS, THE MAYFLOWER, AND THE CLERMONT

1. Columbus and his men left Spain August 3, 1492. They reached the New World October 12, 1492. The voyage took how many days? A calendar may help you.



2. There were 90 men in the crews and 30 other men on all three of the ships. How many men did the ships average?

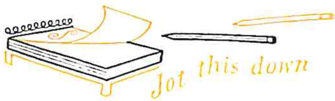
3. If they traveled about 4000 miles in 10 weeks, about how many miles did they average per *day*?

4. The Pilgrims left Europe September 17, 1620. They landed at Plymouth on December 21, 1620. About how many days were they sailing?

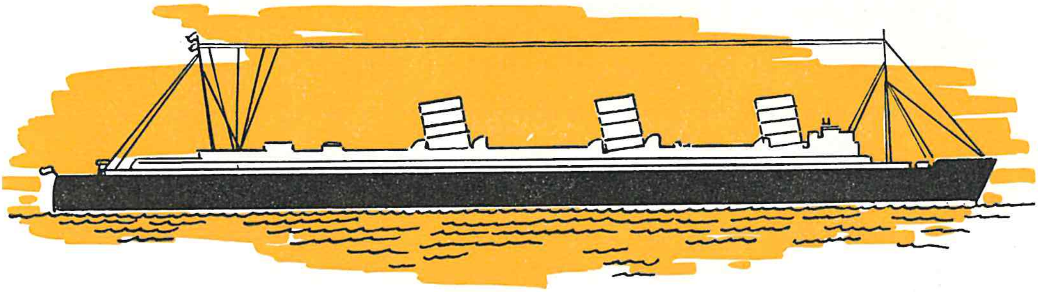
5. If they traveled about 3150 miles in 9 weeks, about how many miles did they average per day?

6. In 1807, Robert Fulton made the first run with his boat, the *Clermont*. He went from New York to Albany, 150 miles upstream, in 32 hours. What was his average speed?

7. The *Clermont* came back from Albany in 30 hr. against the wind. Did it go faster upstream or downstream? A good experiment is to ride a bicycle to know the speed of 5 miles per hour.



The size of a ship is measured by the tons of water it displaces. The *Mayflower* was a 180-ton ship. The *Queen Mary* (next page) is 81,237 tons in size. It is 450 times as big as the *Mayflower*. Read about ships.



THE QUEEN MARY

SIZE OF SHIP		SOME FOOD ITEMS FOR ONE TRIP			
Passengers	2075	Butter	3600 lb.	Coffee,	1200 lb.
Tons	81,237	Eggs	60,000	Potatoes	25 tons
Length	1018 ft.	Sugar	12,800 lb.	Oranges	250 crates
Carpets	6 mi.	Milk	3600 qt.	Meat	20 tons

On one trip there are 3000 passengers and crew. If the food is shared equally –

1. Will each share be more than 1 lb. of butter?

2. About how many pounds of sugar are there for each?

3. Will there be a half pound of coffee for each?

4. How many persons will share a ton of meat?

5. The *Queen Mary* goes about the same distance in less than 5 days as it took the *Mayflower* 63 days to go. The *Queen Mary* goes about how many times as fast?

6. The *Queen Mary's* engines develop 200,000 horsepower. A big railroad engine develops 5000 horsepower. The *Queen Mary's* engines equal the horsepower of about how many big railroad engines?

7. Name something that is about 1018 ft. away.

PRACTICE

Use an answer strip as your teacher reads number questions from page 215.

PLACING THE QUOTIENT DIGITS

1. The divisions below are done for you. Read them.

a. $\begin{array}{r} 23 \\ 3\overline{)69} \end{array}$ **b.** $\begin{array}{r} 33 \\ 5\overline{)165} \end{array}$ **c.** $\begin{array}{r} 45 \\ 7\overline{)315} \end{array}$ **d.** $\begin{array}{r} 62 \\ 9\overline{)558} \end{array}$ **e.** $\begin{array}{r} 34 \\ 6\overline{)204} \end{array}$

In each example the tens' digit in the quotient is placed directly above the tens' digit in the dividend. The ones' digit is directly above the ones' digit.

2. Look at the examples and their answers below. Are the ones in the quotients in the same column as the ones in the dividends? Are the tens in the same column? Do zeros work as other digits?

a. $\begin{array}{r} 52 \\ 43\overline{)2236} \end{array}$ **b.** $\begin{array}{r} 65 \\ 34\overline{)2210} \end{array}$ **c.** $\begin{array}{r} 75 \\ 52\overline{)3900} \end{array}$ **d.** $\begin{array}{r} 84 \\ 42\overline{)3528} \end{array}$

3. Tell where to place the *first* digit of the quotient in each of the examples below. Will it be in ones', tens', or hundreds' place?

a. $4\overline{)84}$	**d.** $2\overline{)126}$	**g.** $21\overline{)651}$	**j.** $32\overline{)128}$	**m.** $72\overline{)936}$
b. $42\overline{)84}$	**e.** $6\overline{)54}$	**h.** $7\overline{)357}$	**k.** $42\overline{)3906}$	**n.** $91\overline{)182}$
c. $3\overline{)12}$	**f.** $2\overline{)648}$	**i.** $8\overline{)816}$	**l.** $64\overline{)256}$	**o.** $25\overline{)625}$

Divide. Place the quotient digits correctly:

	a	b	c	d	e
1.	$6\overline{)258}$	$8\overline{)96}$	$4\overline{)1052}$	$9\overline{)108}$	$7\overline{)1106}$
2.	$11\overline{)590}$	$22\overline{)1124}$	$21\overline{)798}$	$13\overline{)398}$	$37\overline{)888}$
3.	$54\overline{)2610}$	$93\overline{)5301}$	$52\overline{)3695}$	$64\overline{)5192}$	$49\overline{)1990}$

▶ ESTIMATING THE NUMBER OF DIGITS IN THE QUOTIENT

1. Tell what happens to the dividend and quotient in each of the examples below:

a. $\begin{array}{r}3\\2\overline{)6}\end{array}$ b. $\begin{array}{r}30\\2\overline{)60}\end{array}$ c. $\begin{array}{r}300\\2\overline{)600}\end{array}$ d. $\begin{array}{r}3000\\2\overline{)6000}\end{array}$

How many times as large is the dividend in **b** as in **a**?
How many times as large is the quotient in **b** as in **a**?
Can you make other comparisons among these examples?

2. Tell what happens to these divisors and quotients:

a. $\begin{array}{r}2000\\4\overline{)8000}\end{array}$ b. $\begin{array}{r}200\\40\overline{)8000}\end{array}$ c. $\begin{array}{r}20\\400\overline{)8000}\end{array}$ d. $\begin{array}{r}2\\4000\overline{)8000}\end{array}$

Whenever the divisor is multiplied by 10, the quotient is divided by 10. The number of digits in the divisor helps tell where to place the quotient digits.

3. Tell what happens to these dividends and divisors:

a. $\begin{array}{r}4\\3\overline{)12}\end{array}$ b. $\begin{array}{r}4\\30\overline{)120}\end{array}$ c. $\begin{array}{r}4\\300\overline{)1200}\end{array}$ d. $\begin{array}{r}4\\3000\overline{)12000}\end{array}$

If you multiply the dividend and divisor by the same number, is the quotient changed?

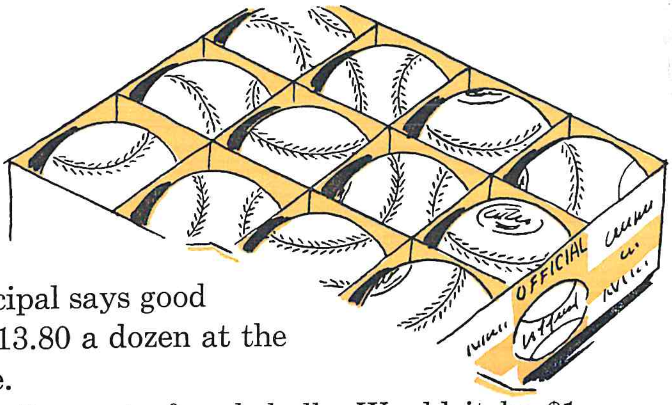
4. Estimate the number of digits there will be in the quotient of each example below. Use check marks to show where quotient digits go. Then divide and compare.

a. $12\overline{)24}$ b. $23\overline{)69}$ c. $32\overline{)128}$ d. $41\overline{)164}$ e. $31\overline{)1302}$

f. $31\overline{)651}$ g. $22\overline{)176}$ h. $42\overline{)1050}$ i. $35\overline{)1120}$ j. $54\overline{)864}$

k. $8\overline{)96}$ l. $6\overline{)288}$ m. $9\overline{)1026}$ n. $43\overline{)1806}$ o. $5\overline{)2755}$

p. $14\overline{)560}$ q. $7\overline{)840}$ r. $12\overline{)4920}$ s. $25\overline{)775}$ t. $36\overline{)1476}$



DIVIDING MONEY

1. Jerry's principal says good new softballs cost \$13.80 a dozen at the sporting goods store.

a. Estimate the cost of each ball. Would it be \$1 even, more than \$1, or less than \$1?

b. Divide \$13.80 by 12 to find the cost.

$$\begin{array}{r} 1\,15 \\ 12\overline{)\$13.80} \\ 12 \\ \hline 1\,8 \\ 1\,2 \\ \hline 60 \\ 60 \\ \hline \end{array}$$

Divide \$13.80 by 12 just as you would if there were no decimal point.

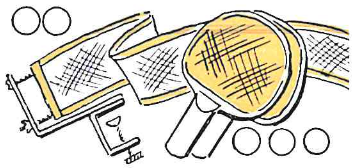
Before you have finished, you must put a decimal point in the answer because the answer is money.

$$\begin{array}{r} \$\,1.15 \\ 12\overline{)\$13.80} \end{array}$$

If you have placed the quotient digits in the right places, you can put the point directly above the decimal point in the dividend.

Is \$1.15 close to your estimate?

After each subtraction in division, you *bring down* one digit from the dividend and divide again.



2. Table tennis balls cost \$1.32 per dozen. How much is the cost for 1 ball?

Divide \$1.32 by 12 as if you were dividing 132 by 12. The answer is 11, but you must put in the decimal point. If 12 balls cost \$1.32, will 1 ball cost about \$11, or \$1, or about a dime? Is the answer \$.11?

When you divide money, put the quotient digits in the right places. Then put the decimal point directly above the decimal point in the dividend. Always check to be sure the answer is reasonable.

REASONABLE QUOTIENTS WITH MONEY

Use good judgment in choosing the most reasonable answer in each of these divisions. Write the answers you choose on paper. Then multiply to check each answer you chose.

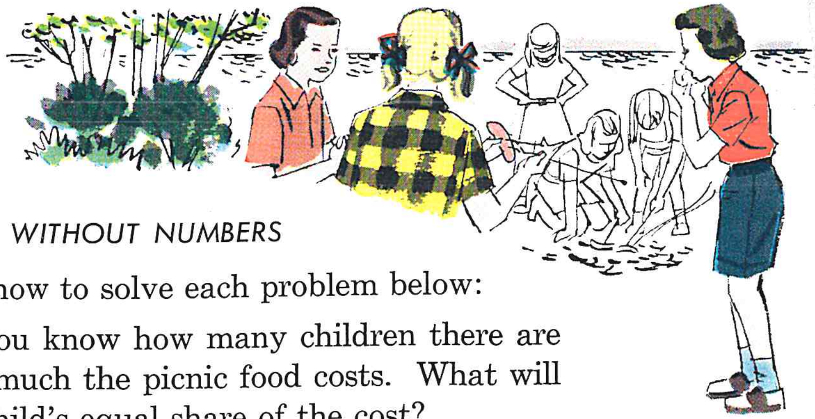
1. $73.50 ÷ 6	=	$122.50	$12.25	$1.22
2. $145.50 ÷ 10	=	$1455.00	$14.55	$1.45
3. $10.40 ÷ 20	=	$52.00	$5.20	$.52
4. $38.40 ÷ 32	=	$12.00	$1.20	$.12
5. $45.15 ÷ 21	=	$21.50	$2.15	$.21
6. $112.50 ÷ 50	=	$225.00	$22.50	$2.25
7. $8.40 ÷ 24	=	$35.00	$3.50	$.35
8. $3.75 ÷ 15	=	$2.50	$.25	$.02
9. $8.82 ÷ 9	=	$98.00	$9.80	$.98
10. $6.25 ÷ 25	=	$25	$2.50	$.25

Will the cost of each thing in Exercises 11–18 be more than a dollar or less than a dollar?

11. $2.75 for 3 dolls.
12. $3.75 for 3 pens.
13. $10.50 for 12 balls.
14. $9.75 for 5 books.
15. $97.50 for 100 chickens.
16. $49.50 for 50 records.
17. $22.60 for 20 tickets.
18. $25.50 for 30 sharpeners.

19. Copy and divide. Estimate each answer first. Then divide the regular way. Place the decimal point correctly. Use good judgment in checking your work. *Bring down* a digit after each subtraction.

a. $12\overline{)\$25.80}$	**b.** $20\overline{)\$82.40}$	**c.** $12\overline{)\$38.88}$	**d.** $24\overline{)\$51.36}$
e. $32\overline{)\$7.36}$	**f.** $41\overline{)\$34.85}$	**g.** $22\overline{)\$9.46}$	**h.** $11\overline{)\$9.35}$
i. $25\overline{)\$55.50}$	**j.** $23\overline{)\$78.66}$	**k.** $32\overline{)\$23.68}$	**l.** $21\overline{)\$687.75}$



PROBLEMS WITHOUT NUMBERS

Tell how to solve each problem below:

1. You know how many children there are and how much the picnic food costs. What will be each child's equal share of the cost?

2. You know how many are in each row and the number of equal rows. How many are there all together?

3. You know how tall you were last year and how tall you are now. How much have you grown in height?

4. You know how much something costs and how much money you have. Have you enough to buy it?

5. You know how many cans of dog food you have and how many cans your dog eats each week. How many weeks will your dog food last?

6. You know what time you came and what time you must go home. How many hours and minutes can you stay?

7. You know how far you rode each day last week. How far did you ride daily on the average?

8. You know how many stamps you had, how many you gave away, and how many more you got. How many do you have now?

9. You are on a trip. You know the date you started, the date now, and the date you plan to go home. How many days of the trip are left?

10. You know how many papers you sold this week and the price of each. You know your total sales for last week. Which week were your sales greater?

WHAT DOES THE ANSWER MEAN?

After you work each problem, write one or two sentences that tell just what the answer means. A problem is done for you to show you how.

1. Nine boys want to buy a ball glove that costs \$4.25. What is each boy's equal share of the cost?

Estimate:	**Lay out the ideas:**	**Example:**
Between 40 and 50 cents each	9 boys \$4.25 in all	$\begin{array}{r} \$\ .47 \\ 9\overline{)\$4.25} \\ 3\,6 \\ \hline 65 \\ 63 \\ \hline 2 \end{array}$

Your sentences: Each boy must pay 47 cents. There are 2 more cents to be paid somehow.

2. Thirty children gave \$7.50 to the Red Cross last month. How much was the average gift? *Remember to write the sentence that tells what the answer means.*

3. It costs about \$2.50 a month to buy food for Spot. How much would it cost a month to buy food for two dogs like Spot?

4. Girls' dresses are \$7.50 each. At the sale you can buy another dress for \$1. How much will the average cost be for each if you buy two dresses?

5. Dorothy can buy water colors for \$1.95 and a set of brushes for \$1.35. What will her change be from \$5.00?

6. Jim can buy 3 yoyos for 25¢. How many can he get for his Scout troup for \$1?

7. Apples cost 22¢ a pound. Sally has 75¢ to buy 3 pounds. How much money will she have left over?

8. Tom cut a melon into four nearly equal pieces. If Tom's piece weighed 6 lb., what did all of the melon weigh?

UNDERSTANDING ZEROS IN DIVISION BETTER

1. Tell how each of these divisions was done:

ZEROS IN THE DIVIDEND

a. $\begin{array}{r} 34 \\ 6\overline{)204} \\ \underline{18} \\ 24 \\ \underline{24} \end{array}$ **b.** $\begin{array}{r} 68 \\ 5\overline{)340} \\ \underline{30} \\ 40 \\ \underline{40} \end{array}$ **c.** $\begin{array}{r} 40 \\ 7\overline{)280} \\ \underline{28} \\ 0 \end{array}$ **d.** $\begin{array}{r} 526 \\ 4\overline{)2104} \\ \underline{20} \\ 10 \\ \underline{8} \\ 24 \\ \underline{24} \end{array}$ **e.** $\begin{array}{r} 75 \\ 8\overline{)600} \\ \underline{56} \\ 40 \\ \underline{40} \end{array}$

2. Tell what happened in each of these divisions:

ZEROS IN THE QUOTIENT

a. $\begin{array}{r} 402 \\ 3\overline{)1206} \\ \underline{12} \\ 06 \\ \underline{6} \end{array}$ **b.** $\begin{array}{r} 703 \\ 5\overline{)3515} \\ \underline{35} \\ 15 \\ \underline{15} \end{array}$ **c.** $\begin{array}{r} 40 \\ 6\overline{)240} \\ \underline{24} \\ 0 \end{array}$ **d.** $\begin{array}{r} 40\frac{1}{2} \\ 2\overline{)81} \\ \underline{8} \\ 1 \end{array}$ **e.** $\begin{array}{r} 300 \\ 4\overline{)1200} \\ \underline{12} \\ 00 \end{array}$

3. What is $0 \div 1$? $0 \div 6$? $0 \div 4$? $0 \div 8$? $0 \div 3$?

4. Divide these examples. Divide zero just as you do other numbers. Do these by short division if you can.

a. $3\overline{)1809}$ **b.** $4\overline{)1608}$ **c.** $2\overline{)1406}$ **d.** $3\overline{)1506}$ **e.** $2\overline{)1204}$

Whenever a remainder in division is still smaller than the divisor after you have brought down the next digit in the dividend, write a zero in the quotient.

5. Copy and divide:

a. $8\overline{)5664}$ **b.** $9\overline{)6354}$ **c.** $6\overline{)5442}$ **d.** $7\overline{)4928}$ **e.** $4\overline{)3236}$

f. $3\overline{)2718}$ **g.** $7\overline{)4263}$ **h.** $8\overline{)4832}$ **i.** $6\overline{)3648}$ **j.** $9\overline{)4572}$

What digit divided by any other digit always gives the same answer?

ZERO IN THE QUOTIENT

1. Divide 8547 by 21.

ESTIMATE	MULTIPLY AND SUBTRACT	BRING DOWN AND COMPARE	BRING DOWN AGAIN. DIVIDE	MULTIPLY, COMPARE AND SUBTRACT
$\begin{array}{r} 4 \\ 21\overline{)8547} \end{array}$	$\begin{array}{r} 4 \\ 21\overline{)8547} \\ 84 \\ \hline 1 \end{array}$	$\begin{array}{r} 40 \\ 21\overline{)8547} \\ 84\downarrow \\ \hline 14 \end{array}$	$\begin{array}{r} 407 \\ 21\overline{)8547} \\ 84\ \downarrow \\ \hline 147 \end{array}$	$\begin{array}{r} 407 \\ 21\overline{)8547} \\ 84 \\ \hline 147 \\ 147 \\ \hline \end{array}$

2. Tell what happened in each step above. The new step is the middle one at the right.

$\begin{array}{r} 4 \\ 21\overline{)8547} \\ 84 \\ \hline 14 \end{array}$

You cannot take a 21 from 14, because 21 is larger than 14. So you write a zero in tens' place in the quotient.

$\begin{array}{r} 40 \\ 21\overline{)8547} \\ 84 \\ \hline 147 \end{array}$

There is still another digit in the dividend. Bring it down to the remainder to make a new partial dividend.

Now you divide 147 by 21.

$\begin{array}{r} 407 \\ 21\overline{)8547} \\ 84 \\ \hline 147 \\ 147 \\ \hline \end{array}$

> Always compare the size of the divisor with each remainder. If the divisor is still larger than the remainder after you bring down a digit, write a zero in the quotient.

3. $34\overline{)10438}$	**4.** $43\overline{)17458}$	**5.** $32\overline{)29024}$	**6.** $23\overline{)11638}$
7. $48\overline{)33792}$	**8.** $96\overline{)48864}$	**9.** $52\overline{)31616}$	**10.** $64\overline{)32512}$
11. $85\overline{)76925}$	**12.** $93\overline{)47244}$	**13.** $65\overline{)19955}$	**14.** $74\overline{)66970}$
15. $86\overline{)34658}$	**16.** $97\overline{)68288}$	**17.** $69\overline{)41676}$	**18.** $78\overline{)62868}$

ZERO IN ONES' PLACE

1. One biscuit will be served to each of 240 children in the school lunchroom today.

How many dozen will it take?

Divide 24 by 12. There is no remainder.

Bring down the ones' digit. How many twelves are there in zero? The answer is zero, so you write 0 in ones' place in the quotient.

$$\begin{array}{r} 20 \\ 12\overline{)240} \\ \underline{24} \\ 0 \end{array}$$

Does 20 seem reasonable? Would 2 dozen seem right? Would 200 dozen for 240 children make sense?

2. Read the examples below. What happened in each?

a. $\begin{array}{r} 3 \\ 12\overline{)36} \\ \underline{36} \end{array}$ **b.** $\begin{array}{r} 30 \\ 12\overline{)360} \\ \underline{36} \\ 0 \end{array}$ **c.** $\begin{array}{r} 300 \\ 12\overline{)3600} \\ \underline{36} \\ 00 \end{array}$ **d.** $\begin{array}{r} 3000 \\ 12\overline{)36000} \\ \underline{36} \\ 000 \end{array}$

Use an answer sheet:

3. $14\overline{)280}$ **4.** $23\overline{)460}$ **5.** $56\overline{)112}$ **6.** $68\overline{)1360}$

7. $25\overline{)50}$ **8.** $12\overline{)1560}$ **9.** $40\overline{)200}$ **10.** $50\overline{)4000}$

11. $45\overline{)900}$ **12.** $50\overline{)600}$ **13.** $35\overline{)1050}$ **14.** $25\overline{)1250}$

15. $32\overline{)1600}$ **16.** $52\overline{)260}$ **17.** $28\overline{)5600}$ **18.** $95\overline{)4750}$

QUOTIENTS WITH ZEROS AND REMAINDERS

1. If 250 children are to be served a bun apiece, how many dozen will it take?

Divide 25 tens by 12. Write 2 in tens' place. There is 1 ten in the remainder. Bring down the 0 in ones' place. Will it take a whole dozen for the ten children who remain? No, it will take only $\frac{10}{12}$ of a dozen. So you write a zero in ones' place and $\frac{10}{12}$ in the quotient.

First:

$$\begin{array}{r} 2 \\ 12\overline{)250} \\ 24 \\ \hline 1 \end{array}$$

Next:

$$\begin{array}{r} 20\frac{10}{12} \\ 12\overline{)250}\phantom{\frac{10}{12}} \\ 24\phantom{\frac{10}{12}} \\ \hline 10\phantom{\frac{10}{12}} \end{array}$$

2. Suppose there are 246 children to be served. How many dozen will it take? You know by now that 240 is how many dozen? First you divide, then you multiply, compare, subtract, compare, and bring down the 6. Is 6 ÷ 12 as much as 1? No, so you put a zero in ones' place. Write the fraction of a dozen after the zero to show that 20 dozen will not be enough.

First:

$$\begin{array}{r} 2 \\ 12\overline{)246} \\ 24 \\ \hline 6 \end{array}$$

Next:

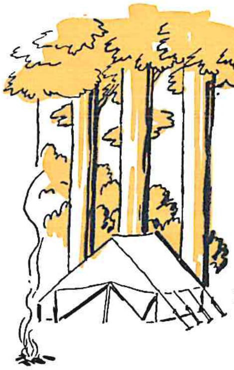
$$\begin{array}{r} 20\frac{6}{12} \\ 12\overline{)246}\phantom{\frac{6}{12}} \\ 24\phantom{\frac{6}{12}} \\ \hline 6\phantom{\frac{6}{12}} \end{array}$$

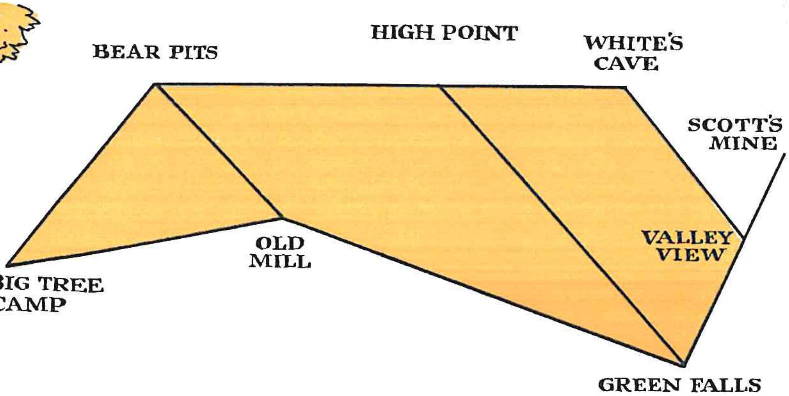
What part of a dozen is 6 buns?

● If the remainder is not enough to divide after you have brought down a digit, write 0 in the quotient. You will know how to write the remainder when you label the answer.

PRACTICE

1. $24\overline{)984}$	**5.** $94\overline{)6016}$	**9.** $84\overline{)5460}$	**13.** $72\overline{)6840}$
2. $32\overline{)2560}$	**6.** $85\overline{)5525}$	**10.** $96\overline{)6720}$	**14.** $64\overline{)3520}$
3. $40\overline{)2480}$	**7.** $57\overline{)3420}$	**11.** $75\overline{)4800}$	**15.** $87\overline{)7830}$
4. $65\overline{)4550}$	**8.** $45\overline{)3150}$	**12.** $43\overline{)3440}$	**16.** $98\overline{)7154}$





SCALE READING AT CAMP

Don and Linda are making plans for their stay at camp. Their map is scaled to 2 miles for each inch. Answer the questions below to the nearest half mile:

1. What is the distance from Big Tree Camp to the Bear Pits? to Scott's Mine? to White's Cave?

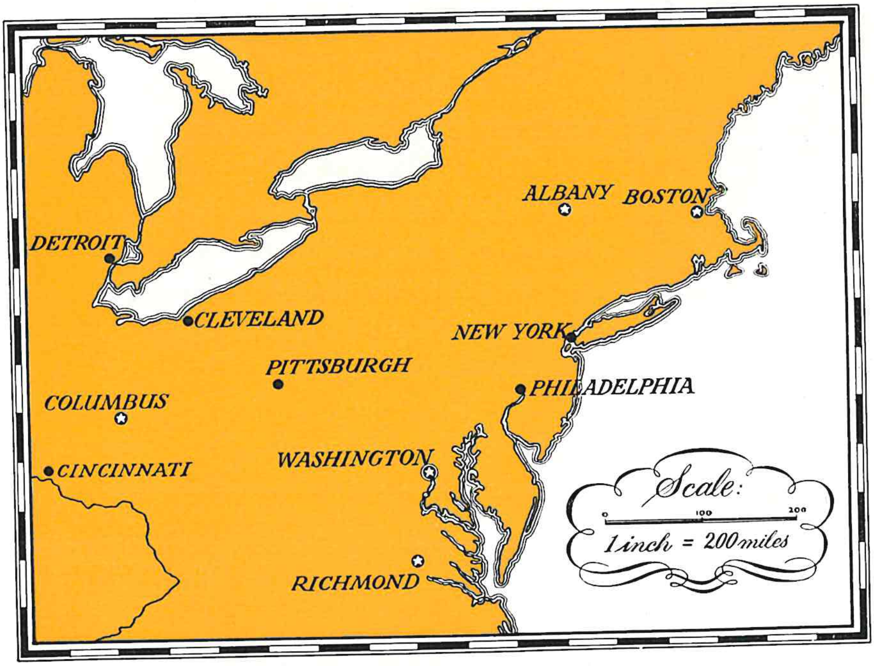
2. How far is it from Old Mill to Green Falls to High Point?

3. What is the distance from Bear Pits to Old Mill?

4. How much closer is White's Cave to Old Mill by going through Bear Pits rather than through Valley View?

5. How far is the grand tour from Big Tree Camp to Scott's Mine? The children plan to go through Green Falls to Scott's Mine and return through Valley View, White's Cave, and Bear Pits to Big Tree Camp.

6. How far apart are White's Cave and Scott's Mine "as the crow flies"?



SCALE READING OF A MAP

On the map above, 1 inch equals 200 miles. Use a ruler or the scale marked on a piece of paper to answer these questions as accurately as you can. How far are these distances? Use an answer sheet.

1. New York to Washington
2. New York to Pittsburgh
3. New York to Detroit
4. Boston to New York
5. Cincinnati to Boston
6. Cleveland to Philadelphia
7. Detroit to Washington
8. Boston to Washington
9. Columbus to Pittsburgh
10. Cleveland to Albany
11. Albany to Boston
12. Pittsburgh to Philadelphia
13. Cleveland to Washington
14. Richmond to Washington
15. Pittsburgh to Detroit
16. Columbus to Washington

WHO'S WHO IN THE ZOO?

Four koalas came from Australia to the San Diego Zoo in 1952 by airplane.

The koala (koh′ah′lah) is not a bear. The koala mother raises her baby in a pouch, like the kangaroo.

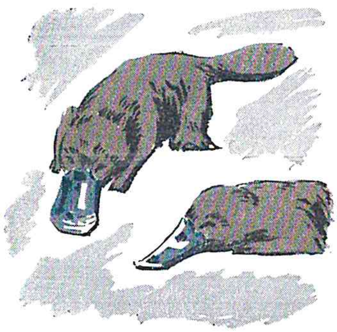
A koala is about 2 feet long and weighs about 10 lb. He lives on eucalyptus leaves and buds.

1. Does this picture show a pair, a trio, or a quartet of koalas?

2. Eucalyptus trees are often 100 feet high. How many times his own height would a koala have to climb to get to the top of a 100-ft. tree?

3. Estimate the weight of a handful of eucalyptus leaves.

4. How long ago did the koalas come to America?



Cecil is a duck-billed platypus in the Bronx Zoo. Penelope is his mate. Cecil came from Australia October 27, 1947. He weighs about $3\frac{2}{3}$ lb. Each day he eats 1 lb. of earthworms (about 750), 20 to 30 crayfish, 1 frog, and 2 eggs made into a custard.

5. Is this an *enormous* appetite for such a small fellow? What does *enormous* mean?

6. How long ago did Cecil come to America? Answer to the nearest year.

7. How long before the koalas came from Australia did Cecil come to America?

WHO'S WHO IN THE ZOO? (continued)

"Bamboo" is a giant gorilla in the Philadelphia Zoo. He arrived at the zoo August 5, 1927. He was about a year old at the time. Bamboo weighs about 435 lb. and is 6 ft. tall. His arm reach (arms outstretched) is 8 ft. Bamboo eats daily about 18 oranges, lettuce or greens equivalent to four heads, 1 lb. of cake made from mixed grain and meat broth, and drinks 6 qt. of water.

1. How long ago did Bamboo arrive at the zoo?

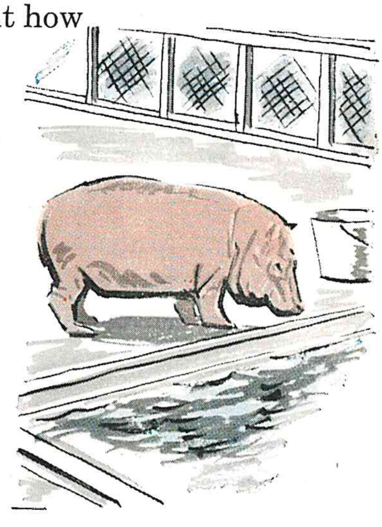
2. Does Bamboo weigh as much as three 140-lb. people?

3. How many dozen oranges does he eat daily?

4. How many gallons of water does he drink daily?

5. About how old is Bamboo now?

6. Estimate your arm reach. About how much farther is Bamboo's arm reach?



Gumdrop XII lives at the zoo in Washington, D. C. He is the twelfth pygmy hippopotamus born in the zoo. He weighed about 8 lb. at birth and will grow to about 600 lb. Pygmy hippos come from Liberia, West Africa. They eat hay, grain, and vegetables.

7. Do you think full-grown Gumdrop XII will eat as much food as Bamboo? Why?

8. A big hippo weighs 3 or 4 tons. Is that about 10 times as heavy as Gumdrop XII when he weighs 600 lb.?

DO YOU UNDERSTAND NUMBERS?

Write the one best answer to each question below. Then discuss how you thought as you answered.

1. Which amount is largest? \$49.50 \$58.75 \$.99 \$65
2. Which number will increase most if each 3 is made a 7? 4963 3985 9364 5836
3. Which number will decrease most if each 6 is made a 5? 6847 7869 2643 9476
4. Half of a thousand is how many? 50 100 500 2000
5. How many dimes can \$3.70 be changed for?
6. Estimate which quotient will be the largest:

   a. $35\overline{)87}$ **b.** $37\overline{)87}$ **c.** $36\overline{)87}$

7. Estimate which product will be the largest:

   a. 32×48 **b.** 32×47 **c.** 32×46

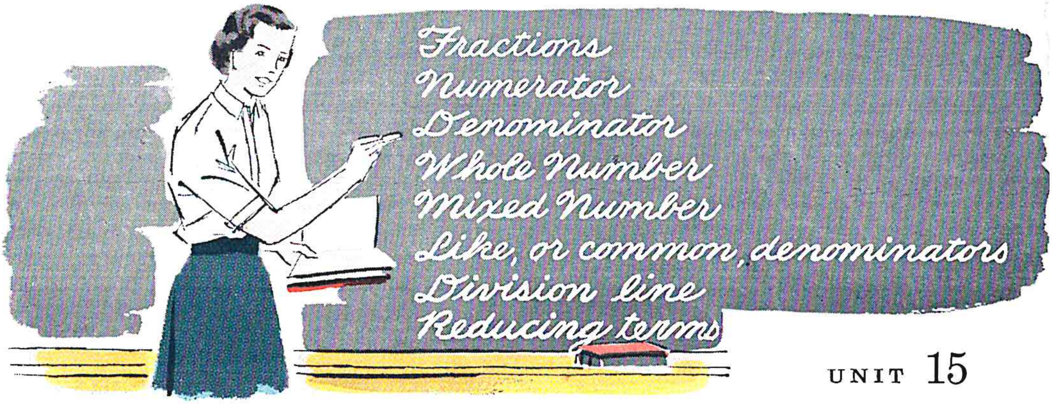
8. Which is largest? $\frac{1}{2}$ $\frac{1}{10}$ $\frac{1}{3}$ $\frac{1}{5}$
9. A degree of temperature is how many fifths?

GROWTH TEST

1. $28 + 159 + 6078 = \underline{?}$
2. $5\frac{3}{8} - 1\frac{1}{8} = \underline{?}$
3. Subtract 4326 from 5103.
4. Multiply 359 by 9.
5. What is $\frac{1}{7}$ of 6601?
6. $40\overline{)840}$
7. Add $\frac{1}{2}$ and $1\frac{1}{4}$.
8. $2\frac{3}{4} - 1\frac{3}{8} = \underline{?}$
9. $3\frac{2}{5} + 4 = \underline{?}$
10. Divide 992 by 31.
11. $\frac{1}{2} + \frac{1}{10} = \underline{?}$
12. $2408 \div 56 = \underline{?}$
13. $4\frac{2}{3} - 2\frac{1}{6} = \underline{?}$
14. $68 \times 690 = \underline{?}$
15. 1410 minus 436 $= \underline{?}$
16. $\frac{3}{4}$ of 3980 $= \underline{?}$
17. Add 49, 65, 577, 60, and 769.
18. Find the product of 586 and 70.
19. Find the sum of 73, 979, 628, and 850.
20. 1646 is how many more than 787?

THE ANSWER STRIP

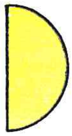
ADDITION	MULTIPLICATION AND CARRY FACTS	DIVISION	QUOTIENT ESTIMATION
(1)	(1)	(1)	(1)
27 and 8	$6 \times 4 + 5$	6's in 18	7's in 31
23 and 9	$8 \times 3 + 6$	5's in 35	6's in 51
24 and 7	$7 \times 6 + 5$	3's in 21	3's in 26
29 and 3	$9 \times 3 + 8$	8's in 32	5's in 43
54 and 6	$4 \times 8 + 3$	4's in 20	9's in 39
(6)	(6)	(6)	(6)
49 and 5	$5 \times 9 + 3$	5's in 40	5's in 32
24 and 8	$9 \times 8 + 8$	4's in 12	4's in 27
27 and 6	$7 \times 4 + 6$	8's in 24	8's in 63
49 and 4	$9 \times 5 + 8$	5's in 30	3's in 29
27 and 5	$8 \times 7 + 4$	4's in 16	7's in 40
(11)	(11)	(11)	(11)
26 and 9	$3 \times 6 + 2$	8's in 72	9's in 61
29 and 8	$9 \times 7 + 8$	3's in 24	8's in 43
48 and 6	$6 \times 6 + 5$	8's in 40	4's in 31
24 and 9	$4 \times 7 + 3$	4's in 24	7's in 53
45 and 7	$9 \times 6 + 8$	3's in 27	9's in 70
(16)	(16)	(16)	(16)
28 and 9	$7 \times 5 + 6$	5's in 45	6's in 46
49 and 6	$9 \times 4 + 7$	6's in 54	7's in 67
36 and 7	$6 \times 8 + 4$	7's in 49	4's in 38
28 and 5	$7 \times 9 + 6$	4's in 36	8's in 69
25 and 9	$8 \times 8 + 7$	7's in 63	5's in 48
(21)	(21)	(21)	(21)
49 and 7	$7 \times 7 + 6$	8's in 48	7's in 47
36 and 8	$4 \times 9 + 3$	7's in 42	4's in 35
48 and 7	$7 \times 8 + 5$	4's in 32	8's in 53
45 and 8	$8 \times 6 + 5$	7's in 56	7's in 61
17 and 9	$6 \times 9 + 3$	6's in 42	6's in 58



UNIT 15

USING MIXED NUMBERS

▶ WORDS YOU SHOULD KNOW

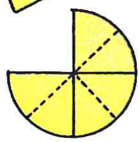
A


1. Which word above tells the size of a part?

2. Which word tells the number of parts?

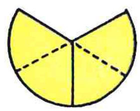
B


3. What is the denominator for each of the Figures *A*, *B*, *C*, and *D*? the numerator?

C


4. Name the size of Figure *C* two ways.

5. When you say Figure *D* is $\frac{4}{6}$ and then say $\frac{4}{6}$ is $\frac{2}{3}$, which words on the chalkboard tell what you are doing?

D


6. When you change the numerator and denominator by dividing each by the same number, do you change the value of the fraction?

$$\frac{4 \div 2}{6 \div 2} = \frac{2}{3}$$

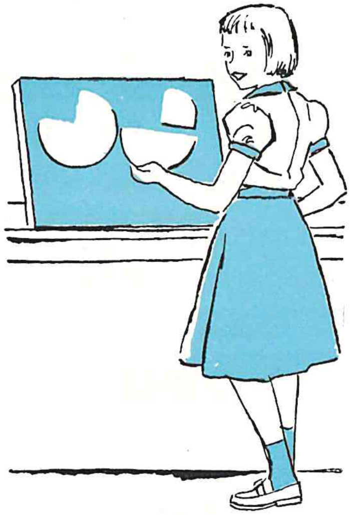
7. Explain why $\frac{2}{3}$ is said to be in *lower terms* than $\frac{4}{6}$.

8. How would you write the size of a part if one apple is divided into 4 equal parts?

9. What two things are put together to make a mixed number?

10. If two fractions have *like* denominators, do the fractions have to be equal?

▶ RELATED FRACTIONS

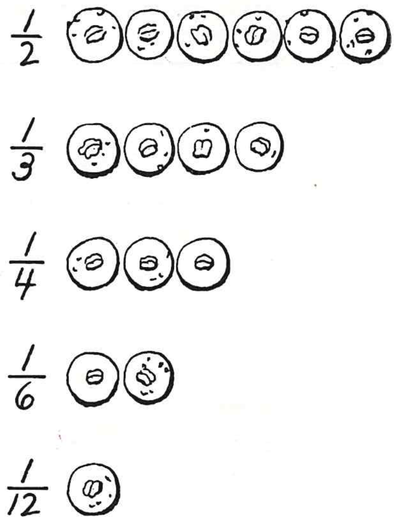


1. Janet shows on the flannel board that $\frac{3}{4}$ of a circle in one piece is equal to $\frac{1}{2}$ and $\frac{1}{4}$ of another circle the same size.

Can Janet change $\frac{1}{2}$ into quarters? Will there by any left over? Can halves be changed to quarters evenly?

2. Below are 5 fractions of a dozen cookies.

Is the largest part near the top or at the bottom? As the size of the parts gets smaller, the denominator gets (*larger* or *smaller.*)



3. $\frac{1}{2}$ is how many 4ths? 6ths? 12ths?

4. $\frac{1}{3}$ is how many 6ths? 12ths?

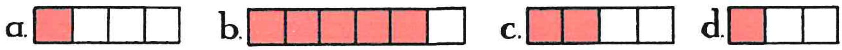
5. $\frac{1}{4}$ is how many 12ths?

6. $\frac{1}{6}$ is how many 12ths?

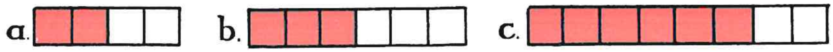
7. Why can't you change thirds into an even number of fourths, or change fourths into sixths? Can four be divided evenly by 3? Can 6 be divided evenly by 4?

WHAT DO YOU REMEMBER ABOUT FRACTIONS?

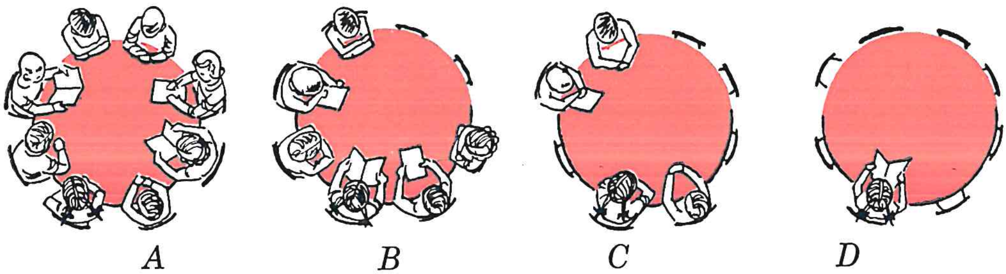
1. Write the fraction number for the colored part, and for the part that is not colored in each rectangle below:



2. Write the fraction number of each colored part in two ways, with different denominators:



3. a. How many children are seated at Table *A*?

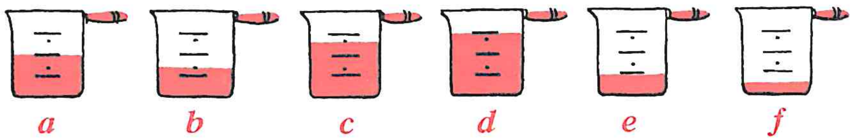


b. What fraction of 8 children have left Table *B*?

c. What fraction of 8 children are still at *C*?

d. What fraction of 8 children have left Table *D*?

4. Which of the cups below seems to be nearest $\frac{1}{2}$ full? $\frac{1}{6}$ full? $\frac{1}{3}$ full? $\frac{1}{4}$ full? $\frac{2}{3}$ full? $\frac{3}{4}$ full?



5. Which is the largest fraction? $\frac{1}{3}$ $\frac{1}{6}$ $\frac{1}{4}$ $\frac{1}{5}$

6. Which is the smallest fraction? $\frac{1}{2}$ $\frac{1}{8}$ $\frac{1}{3}$ $\frac{1}{4}$

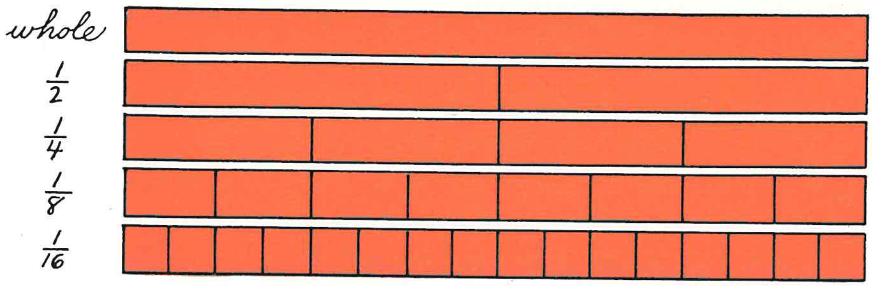
7. Which is the smallest fraction? $\frac{5}{8}$ $\frac{3}{8}$ $\frac{6}{8}$ $\frac{8}{8}$

8. What is the numerator of $\frac{3}{8}$? the denominator?

9. Which is the largest part of a pie? $\frac{2}{3}$ $\frac{2}{6}$ $\frac{2}{4}$ $\frac{2}{5}$

INCREASING AND REDUCING TERMS

You have used a fraction chart like this before. Use this one the same way to answer the questions below:



1. $\frac{1}{2}$ is how many 8ths?
2. $\frac{2}{4}$ is how many halves?
3. $\frac{3}{4}$ is how many 8ths?
4. $\frac{2}{4} = \frac{?}{2}$
5. $\frac{4}{8} = \frac{?}{2}$
6. $\frac{8}{16} = \frac{?}{2}$
7. $\frac{6}{8} = \frac{?}{4}$
8. $\frac{7}{8} = \frac{?}{16}$
9. $\frac{10}{16} = \frac{?}{8}$

Change these fractions without using a chart:

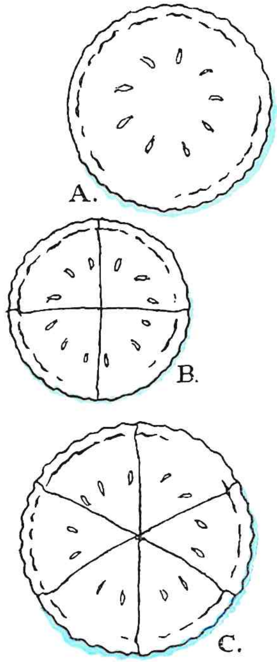
10. $\frac{2}{6} = \frac{?}{3}$
11. $\frac{3}{9} = \frac{?}{3}$
12. $\frac{6}{12} = \frac{?}{2}$
13. $\frac{9}{12} = \frac{?}{4}$
14. $\frac{4}{6} = \frac{?}{3}$
15. $\frac{8}{12} = \frac{?}{3}$
16. $\frac{1}{2} = \frac{?}{12}$
17. $\frac{1}{4} = \frac{?}{12}$

To change to lower terms, *divide* the numerator and the denominator of a fraction by the same number. To change to higher terms, *multiply* the numerator and the denominator of a fraction by the same number.

PRACTICE

Change the terms of the fractions below:

1. $\frac{1}{2}$ to 6ths
2. $\frac{1}{3}$ to 6ths
3. $\frac{1}{2}$ to 8ths
4. $\frac{4}{8}$ to halves
5. $\frac{4}{6}$ to 3rds
6. $\frac{6}{8}$ to 4ths
7. $\frac{5}{10}$ to halves
8. $\frac{2}{3}$ to 6ths
9. $\frac{6}{10}$ to 5ths
10. $\frac{3}{4}$ to 8ths
11. $\frac{2}{8}$ to 4ths
12. $\frac{8}{16}$ to halves



A. B. C.

FRACTIONS WHICH MAKE ONE WHOLE

1. There are three children in the Martin family. Dad and Mother make 5 people. Into how many pieces do you suppose they cut a pie for one meal?

2. There are 4 people in the Grant family. Into how many pieces would they cut a pie if they were going to eat it at one meal?

3. The Hart family has 6 people. How would their pie be cut?

4. If the Martins, Grants, and the Harts all have the same amount of pie in each piece, who must have the biggest pie?

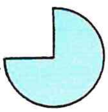
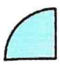
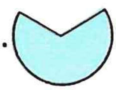
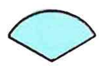
5. Is $\frac{1}{4}$ of one pie larger than $\frac{1}{6}$ of another pie? The answer depends on what?

6. In Pie *B*, 1 piece and 3 pieces are how much of a pie? $\frac{1}{4} + \frac{3}{4} = \underline{\ ?\ }$

7. In Pie *C*, 1 piece and 5 pieces are how much of a pie? $\frac{1}{6} + \frac{5}{6} = \underline{\ ?\ }$

8. In Pie *C*, 2 pieces and 4 pieces are how much of a pie? $\frac{2}{6} + \frac{4}{6} = \underline{\ ?\ }$

9. Answer the circle examples below:

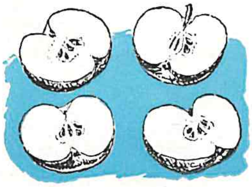
A.  +  = ? **B.**  +  = ?

10. Tell in which of these the sum is 1, in which it is more than 1, and in which it is less than 1:

a. $\frac{1}{2} + \frac{1}{2}$	**e.** $\frac{1}{3} + \frac{2}{3}$	**i.** $\frac{1}{4} + \frac{2}{4}$	**m.** $\frac{1}{5} + \frac{4}{5}$
b. $\frac{2}{6} + \frac{3}{6}$	**f.** $\frac{3}{5} + \frac{3}{5}$	**j.** $\frac{3}{8} + \frac{5}{8}$	**n.** $\frac{2}{4} + \frac{3}{4}$
c. $\frac{3}{6} + \frac{4}{6}$	**g.** $\frac{2}{3} + \frac{2}{3}$	**k.** $\frac{3}{5} + \frac{2}{5}$	**o.** $\frac{1}{2} + \frac{2}{4}$
d. $\frac{1}{4} + \frac{6}{8}$	**h.** $\frac{1}{3} + \frac{5}{6}$	**l.** $\frac{1}{2} + \frac{3}{8}$	**p.** $\frac{3}{4} + \frac{1}{8}$

MEANING OF IMPROPER FRACTIONS

1. So far most of the fractions we have used have been **proper** fractions. A fraction is a **proper** fraction when it is less than one whole thing. $\frac{2}{3}$, $\frac{1}{2}$, $\frac{5}{8}$, and $\frac{3}{5}$ are proper fractions. Is the numerator in each fraction smaller than the denominator?



2. Mrs. Grant has half of an apple for each of 4 boys. How many apples did she cut into halves?

Does $\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = \frac{4}{2}$?

If 2 halves equal 1 whole, how many do 4 halves equal?

3. Mrs. Grant has pies cut into fifths. The boys eat $\frac{2}{5}$ of one pie and $\frac{4}{5}$ of another the same size. How much do they eat all together?

Does $\frac{2}{5} + \frac{4}{5} = \frac{6}{5}$? Is $\frac{6}{5}$ the same as $\frac{5}{5} + \frac{1}{5}$?

Does $\frac{5}{5} + \frac{1}{5} = 1 + \frac{1}{5}$? $1 + \frac{1}{5}$ is the same as $1\frac{1}{5}$.

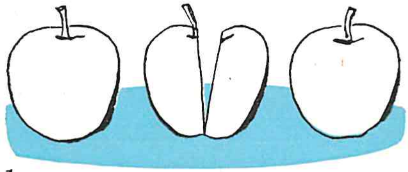
4. How many thirds equal 1? Then $\frac{4}{3}$ equals 1 and how many thirds? $\frac{5}{3} = 1$ and how many thirds?

5. Explain why these are equal:

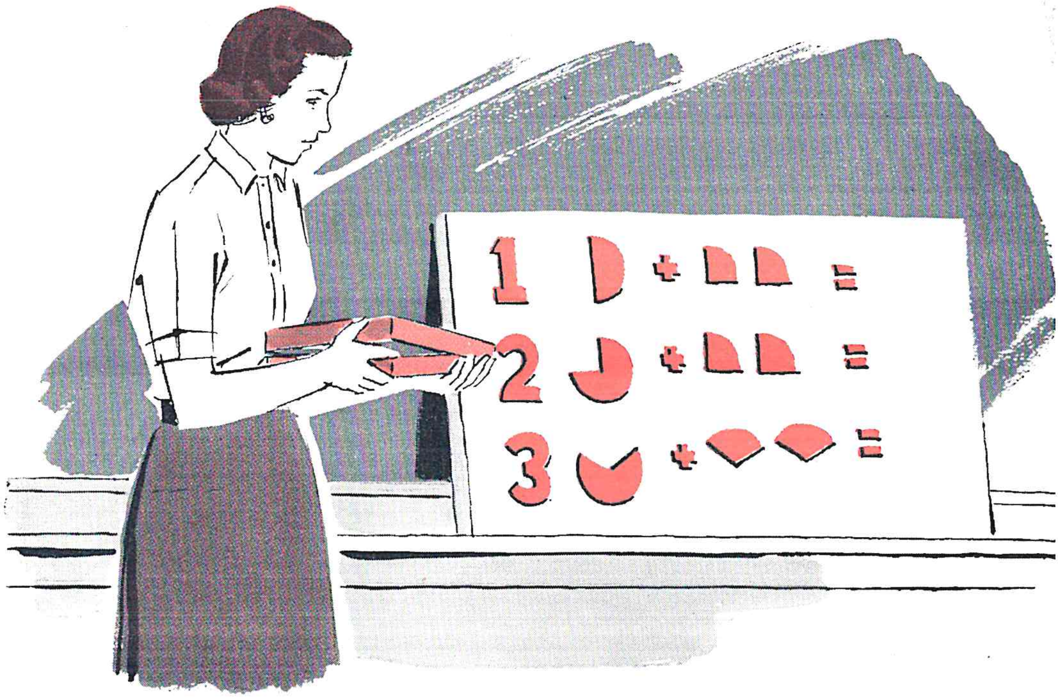
a. $\frac{3}{2} = 1$ and $\frac{1}{2}$	**b.** $\frac{7}{5} = 1$ and $\frac{2}{5}$	**c.** $\frac{7}{4} = 1$ and $\frac{3}{4}$
d. $\frac{8}{5} = 1\frac{3}{5}$	**e.** $\frac{7}{6} = 1\frac{1}{6}$	**f.** $\frac{9}{8} = 1\frac{1}{8}$

• This new kind of fraction is called an **improper** fraction. An improper fraction is equal to or is larger than one whole thing, as $\frac{4}{4}$, $\frac{3}{3}$, $\frac{3}{2}$, and $\frac{6}{5}$.

6. Each of two boys is taking $\frac{1}{2}$ of 3 apples. $\frac{1}{2}$ of 3 is $\frac{3}{2}$. This means $3 \div 2$, or $2\overline{)3}$. Do the division.



• A number with a fraction, as $1\frac{1}{3}$, is called a **mixed** number.



▶ SUMS WHICH ARE IMPROPER FRACTIONS

Miss Adams has placed three examples on the flannel board. Read each of the examples.

1. Can you see in Example 1 *one half plus two* of the *one fourths*? It could be $\frac{1}{2} + \frac{1}{4} + \frac{1}{4}$ or $\frac{1}{2} + \frac{2}{4}$.

Will the sum be $\frac{4}{4}$? If you put the parts together, will you have a whole circle, or more, or less?

2. Do you see in Example 2, $\frac{3}{4} + \frac{2}{4}$?

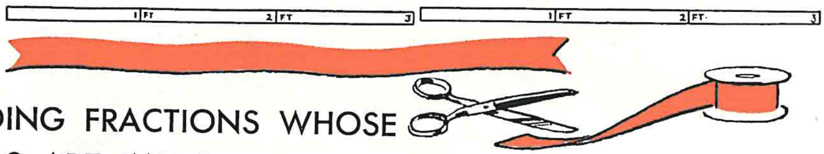
If you put the pieces together, you will have a whole and what fraction over?

3. Are **a**, **b**, and **c** below correct?

a. $\frac{3}{4} + \frac{2}{4} = \frac{5}{4}$ **b.** $\frac{3}{4} + \frac{1}{4} + \frac{1}{4} = \frac{5}{4}$ **c.** $\frac{5}{4} = 1\frac{1}{4}$

4. What do you see when you put the thirds together in Example 3 on the flannel board?

Write the addition and change the improper fraction to a mixed number as we did for Example 2.



ADDING FRACTIONS WHOSE SUMS ARE IMPROPER FRACTIONS

1. How much is $\frac{2}{3} + \frac{1}{3}$?

Three thirds $(\frac{3}{3})$ = 1 whole thing.

$$\begin{array}{rl} \text{2 thirds} & \frac{2}{3} \\ +\text{1 third} & \frac{1}{3} \\ \hline \text{3 thirds} & \frac{3}{3} = 1 \end{array}$$

• When the numerator and the denominator are equal, the fraction equals 1.

$\frac{3}{3} = 3 \div 3 = 1$

2. Gloria wants to tie her hair with two ribbons. Each must be $\frac{2}{3}$ of a yard long. How much ribbon should she buy?

Gloria places two yardsticks together. She knows that a foot is a third of a yard. Two thirds of a yard comes to the 2-foot mark. Another $\frac{2}{3}$ reaches 1 yd. and $\frac{1}{3}$ of another yard. Does $4 \div 3 = 1\frac{1}{3}$? Explain why $\frac{4}{3}$ yd. = $1\frac{1}{3}$ yd.

$$\begin{array}{l} \frac{2}{3}\text{ yd.} \\ \frac{2}{3}\text{ yd.} \\ \hline \frac{4}{3}\text{ yd.} = 1\frac{1}{3}\text{ yd.} \end{array}$$

3. If Gloria wanted 3 ribbons each $\frac{2}{3}$ yd. long, she could mark off $\frac{2}{3}$ yd. three times. How many thirds is $\frac{2}{3} + \frac{2}{3} + \frac{2}{3}$?

$$\begin{array}{rl} \text{2 thirds} & \frac{2}{3} \\ \text{2 thirds} & \frac{2}{3} \\ \text{2 thirds} & \frac{2}{3} \\ \hline \text{6 thirds} & \frac{6}{3} = 2 \end{array}$$

If $\frac{3}{3}$ = 1 whole yard, then $\frac{6}{3}$ = ?

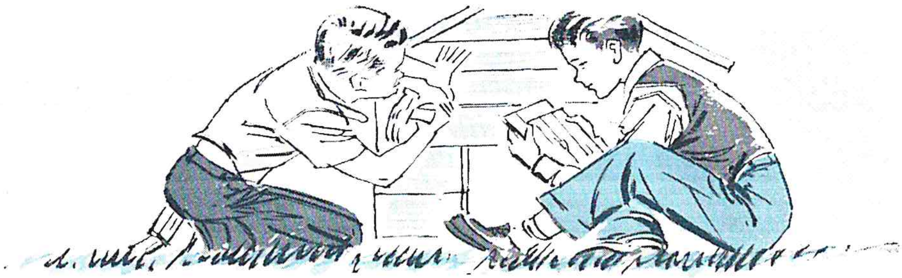
4. Tell what happened in each of these additions:

a. $\frac{1}{4} + \frac{3}{4} = \frac{4}{4} = 1$ **b.** $\frac{3}{5} + \frac{4}{5} = \frac{7}{5} = 1\frac{2}{5}$

c. $\frac{3}{8} + \frac{7}{8} = \frac{10}{8} = 1\frac{2}{8}$

5. Add each of these:

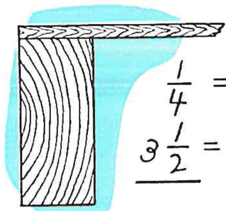
a.	b.	c.	d.	e.	f.	g.	h.
$\frac{1}{2}$	$\frac{1}{3}$	$\frac{3}{5}$	$\frac{4}{6}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{3}{4}$	$\frac{5}{8}$
$\frac{1}{2}$	$\frac{2}{3}$	$\frac{3}{5}$	$\frac{4}{6}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{7}{8}$



ADDING MIXED NUMBERS AND PROPER FRACTIONS WITH CARRYING

Tony and Carl learned some interesting facts about lumber as they built Carl's doghouse. "A two-by-four really is $1\frac{1}{2}$ by $3\frac{1}{2}$," said Carl. "An inch board is a $\frac{3}{4}$-in. board. You have to allow for the wood used in planing it smooth."

1. What is the thickness when a $\frac{1}{4}$-in. board is nailed to a $3\frac{1}{2}$-in. board?



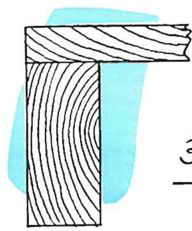
$$\begin{aligned} \frac{1}{4} &= \frac{1}{4} \\ 3\frac{1}{2} &= 3\frac{2}{4} \\ \hline & \;\; 3\frac{3}{4}\text{ in.} \end{aligned}$$

Do you first add the proper fraction and the fraction of the mixed number in the same way you add two proper fractions? What do you do with the whole number?

2. Add these without pencil and paper:

a. $3\frac{1}{3} + \frac{1}{3}$	**b.** $2\frac{1}{5} + \frac{2}{5}$	**c.** $\frac{1}{4} + 1\frac{1}{4}$	**d.** $\frac{1}{6} + 2\frac{2}{6}$
e. $3\frac{1}{5} + \frac{3}{5}$	**f.** $1\frac{1}{2} + \frac{1}{4}$	**g.** $\frac{3}{8} + 2\frac{1}{8}$	**h.** $\frac{1}{2} + 1\frac{1}{2}$

3. Tony is trying to think how thick a $3\frac{1}{2}$-in. piece and a $\frac{3}{4}$-in. board will be. He thinks $3\frac{1}{2}$ and $\frac{2}{4} = 4$, and $\frac{1}{4} = 4\frac{1}{4}$. Is he right?



$$\begin{aligned} \frac{3}{4} &= \frac{3}{4} \\ 3\frac{1}{2} &= 3\frac{2}{4} \\ \hline & \;\; 3\frac{5}{4} \end{aligned}$$

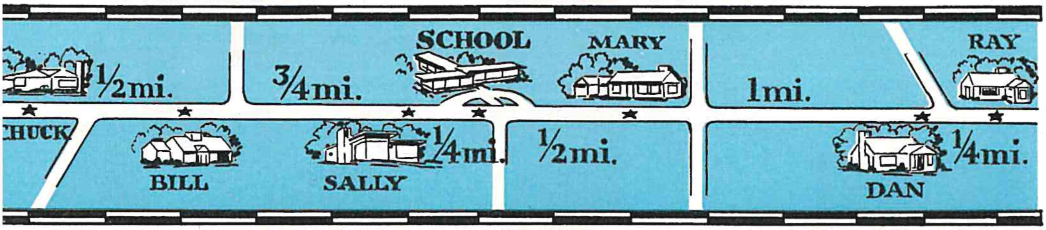
$\frac{5}{4} = 1\frac{1}{4}$ $\quad 1\frac{1}{4} + 3 = 4\frac{1}{4}$ in.

4. Add these without pencil and paper. Write only the answers. Then add with pencil to check.

a.	**b.**	**c.**	**d.**	**e.**	**f.**	**g.**
$1\frac{2}{3}$	$2\frac{3}{5}$	$\frac{2}{4}$	$\frac{7}{8}$	$1\frac{1}{5}$	$\frac{1}{2}$	$1\frac{1}{3}$
$\underline{\frac{2}{3}}$	$\underline{\frac{4}{5}}$	$\underline{1\frac{3}{4}}$	$\underline{2\frac{5}{8}}$	$\underline{\frac{4}{5}}$	$\underline{2\frac{3}{4}}$	$\underline{\frac{2}{3}}$

ADDING MIXED NUMBERS WITH CARRYING

1. Dan's friends say they live these distances from each other:



a. How far is Dan from school? Chuck?

b. From Dan's home to Chuck's is $1\frac{1}{2}$ mi. + $1\frac{1}{2}$ mi. What is the total?

c. From Ray's home to school is $1\frac{3}{4}$ miles. How far is a round trip?

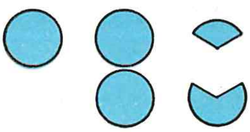
d. Ray lives $1\frac{3}{4}$ mi. from school. Chuck lives $1\frac{1}{2}$ mi. from school. How far apart do they live?

$$\begin{array}{r} 1\frac{1}{2} \\ \underline{1\frac{1}{2}} \\ 2\frac{2}{2} = 3 \end{array}$$

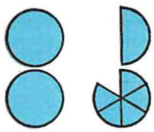
$$\begin{array}{r} 1\frac{3}{4} \\ \underline{1\frac{3}{4}} \\ 2\frac{6}{4} \end{array} \quad \frac{6}{4} = 1\frac{2}{4}$$

$$2\frac{6}{4} = 3\frac{2}{4}$$

2. Tell how the examples below are added:



$$\begin{array}{r} 2\frac{1}{3} \\ \underline{1\frac{2}{3}} \\ 3\frac{3}{3} = 4 \end{array}$$

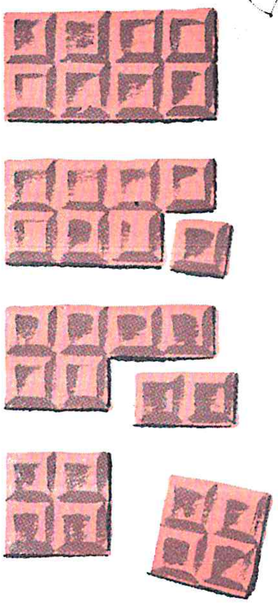


$$\begin{array}{l} 1\frac{1}{2} = 1\frac{3}{6} \\ 1\frac{5}{6} = \underline{1\frac{5}{6}} \\ \qquad 2\frac{8}{6} = 3\frac{2}{6} = 3\frac{1}{3} \end{array}$$

3. When the sum of the fractions is an improper fraction, what must you do?

4. Add and change sums to lowest terms:

a	b	c	d	e
$2\frac{1}{2} + 1\frac{1}{4}$	$2\frac{3}{8} + 2\frac{5}{8}$	$1\frac{5}{8} + 1\frac{1}{2}$	$1\frac{3}{4} + 2\frac{5}{8}$	$2\frac{2}{3} + 1\frac{5}{6}$
$1\frac{1}{8} + 2\frac{3}{8}$	$3\frac{4}{5} + 1\frac{4}{5}$	$1\frac{5}{6} + 3\frac{1}{2}$	$2\frac{3}{4} + 1\frac{1}{2}$	$2\frac{3}{5} + 2\frac{7}{10}$
$3\frac{3}{16} + 1\frac{7}{8}$	$1\frac{1}{6} + 2\frac{1}{2}$	$3\frac{5}{8} + 3\frac{1}{4}$	$4\frac{5}{6} + 2\frac{5}{12}$	$6\frac{1}{2} + 3\frac{7}{8}$



SUBTRACTING A FRACTION FROM ONE WHOLE

Nancy has a big chocolate bar. She is sharing it with her friends.

1. If the first girl takes $\frac{1}{8}$, how much of the bar will Nancy have left?

2. If a girl takes $\frac{1}{4}$ of the whole bar, how much will Nancy have left?

3. How much will Nancy have left if she gives half of the whole bar away?

4. These are the numbers for Nancy's subtractions. Can you explain them?

a. $1 \text{ bar} = \begin{array}{r} \frac{8}{8} \\ -\frac{1}{8} \\ \hline \frac{7}{8} \end{array}$ **b.** $1 \text{ bar} = \begin{array}{r} \frac{4}{4} \\ -\frac{1}{4} \\ \hline \frac{3}{4} \end{array}$ **c.** $1 \text{ bar} = \begin{array}{r} \frac{2}{2} \\ -\frac{1}{2} \\ \hline \frac{1}{2} \end{array}$

5. Change the 1 to a fraction and do each subtraction:

a. $\begin{array}{r} 1 \\ \underline{\frac{1}{4}} \end{array}$ **b.** $\begin{array}{r} 1 \\ \underline{\frac{1}{3}} \end{array}$ **c.** $\begin{array}{r} 1 \\ \underline{\frac{1}{5}} \end{array}$ **d.** $\begin{array}{r} 1 \\ \underline{\frac{2}{3}} \end{array}$ **e.** $\begin{array}{r} 1 \\ \underline{\frac{3}{8}} \end{array}$ **f.** $\begin{array}{r} 1 \\ \underline{\frac{2}{5}} \end{array}$ **g.** $\begin{array}{r} 1 \\ \underline{\frac{3}{4}} \end{array}$

SUBTRACTING A PROPER FRACTION FROM WHOLE NUMBERS

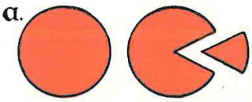
Larry has 3 cans of dog food left. He feeds $\frac{1}{2}$ can a day. How much will he have tomorrow?

$$\begin{array}{r} 3 \\ -\frac{1}{2} \\ \hline \end{array} \qquad \begin{array}{r} 2\frac{2}{2} \\ -\frac{1}{2} \\ \hline 2\frac{1}{2} \end{array}$$

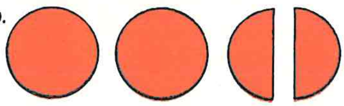
ANSWER: $2\frac{1}{2}$ cans

• When you subtract a proper fraction from a whole number, change one of the ones to a fraction of the same denominator so that you can subtract.

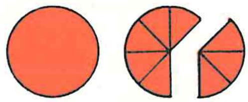
1. Write the subtraction numbers for each picture below. Write the whole number and then the part that is being taken away. The first is done for you.

a. 

$$\begin{array}{r} 2 \\ -\frac{1}{8} \\ \hline \end{array} = \begin{array}{r} 1\frac{8}{8} \\ -\frac{1}{8} \\ \hline 1\frac{7}{8} \end{array}$$

b. 

c. 

d. 

2. Ruth says another quarter hour will make an even 2 hours of play. How long has she played now?

3. What is the difference between $\frac{3}{4}$ mi. and 2 mi.? between $\frac{1}{2}$ mi. and 3 mi.? between $\frac{3}{10}$ mi. and 2 mi.?

4. Answer on folded paper. Subtract in the first row and add in the second row.

a.	**b.**	**c.**	**d.**	**e.**	**f.**	**g.**
1	3	2	3	8	10	12
$\frac{1}{5}$	$\frac{3}{4}$	$\frac{7}{8}$	$\frac{1}{6}$	$\frac{3}{8}$	$\frac{1}{3}$	$\frac{1}{2}$

h.	**i.**	**j.**	**k.**	**l.**	**m.**	**n.**
$\frac{1}{4}$	3	$1\frac{2}{3}$	$2\frac{1}{2}$	2	10	$16\frac{4}{5}$
3	$1\frac{5}{6}$	4	5	$3\frac{3}{8}$	$5\frac{3}{4}$	12

SUBTRACTING A MIXED NUMBER FROM A WHOLE NUMBER

1. Carol bought 5 yards of ribbon. She used $1\frac{1}{2}$ yards of it. How much does she have left? Carol thinks, "I had 5 yards. 5 yards − 1 yard leaves 4 yards. 4 yards − $\frac{1}{2}$ yard leaves $3\frac{1}{2}$ yards."

Carol could write the numbers this way.

$$\begin{array}{rcr} 5 & = & 4\frac{2}{2} \\ -1\frac{1}{2} & = & \underline{1\frac{1}{2}} \\ & & 3\frac{1}{2} \end{array}$$

She thinks of 1 of the 5 yards as being two half yards.

• A mixed number is subtracted from a whole number in the same way that a proper fraction is subtracted from a whole number. Be sure that you do not forget that you have used a *one* when you change it into a fraction, as $\frac{2}{2}$ in the example above.

2. Find the difference for each of these subtractions:

a. $\begin{array}{r}4\\ \underline{1\frac{1}{2}}\end{array}$	**b.** $\begin{array}{r}3\\ \underline{1\frac{3}{4}}\end{array}$	**c.** $\begin{array}{r}2\\ \underline{1\frac{2}{3}}\end{array}$	**d.** $\begin{array}{r}4\\ \underline{2\frac{3}{5}}\end{array}$	**e.** $\begin{array}{r}3\\ \underline{2\frac{3}{8}}\end{array}$	**f.** $\begin{array}{r}3\\ \underline{1\frac{1}{6}}\end{array}$	**g.** $\begin{array}{r}2\\ \underline{1\frac{7}{10}}\end{array}$

PRACTICE

Find the difference for each example below. Reduce each answer to its lowest terms.

1. $\begin{array}{r}\frac{4}{5}\\ \underline{\frac{2}{5}}\end{array}$	**5.** $\begin{array}{r}3\frac{3}{5}\\ \underline{2\frac{1}{5}}\end{array}$	**9.** $\begin{array}{r}3\frac{5}{8}\\ \underline{2\phantom{\frac{1}{1}}}\end{array}$	**13.** $\begin{array}{r}\frac{5}{6}\\ \underline{\frac{2}{3}}\end{array}$	**17.** $\begin{array}{r}3\frac{5}{6}\\ \underline{3\frac{2}{3}}\end{array}$	**21.** $\begin{array}{r}2\frac{2}{3}\\ \underline{2\phantom{\frac{1}{1}}}\end{array}$
2. $\begin{array}{r}2\\ \underline{\frac{2}{3}}\end{array}$	**6.** $\begin{array}{r}3\\ \underline{1\frac{3}{4}}\end{array}$	**10.** $\begin{array}{r}2\frac{7}{8}\\ \underline{\frac{3}{8}}\end{array}$	**14.** $\begin{array}{r}2\\ \underline{\frac{1}{4}}\end{array}$	**18.** $\begin{array}{r}2\\ \underline{1\frac{4}{5}}\end{array}$	**22.** $\begin{array}{r}2\frac{3}{4}\\ \underline{\frac{5}{8}}\end{array}$
3. $\begin{array}{r}2\frac{2}{5}\\ \underline{1\phantom{\frac{1}{1}}}\end{array}$	**7.** $\begin{array}{r}\frac{7}{8}\\ \underline{\frac{5}{8}}\end{array}$	**11.** $\begin{array}{r}2\frac{3}{4}\\ \underline{1\frac{1}{2}}\end{array}$	**15.** $\begin{array}{r}4\frac{3}{5}\\ \underline{4\phantom{\frac{1}{1}}}\end{array}$	**19.** $\begin{array}{r}\frac{7}{8}\\ \underline{\frac{1}{4}}\end{array}$	**23.** $\begin{array}{r}2\frac{2}{3}\\ \underline{2\frac{1}{6}}\end{array}$
4. $\begin{array}{r}3\frac{2}{3}\\ \underline{\frac{1}{3}}\end{array}$	**8.** $\begin{array}{r}3\\ \underline{\frac{3}{8}}\end{array}$	**12.** $\begin{array}{r}5\\ \underline{2\frac{7}{8}}\end{array}$	**16.** $\begin{array}{r}1\frac{5}{8}\\ \underline{\frac{1}{4}}\end{array}$	**20.** $\begin{array}{r}3\\ \underline{\frac{2}{3}}\end{array}$	**24.** $\begin{array}{r}3\\ \underline{2\frac{5}{12}}\end{array}$

Do the problems on this page by changing the measures to fractions. Do fractions help?

1. Write as fractions: **a.** 3 yd. 1 ft.; **b.** 1 gal. 1 qt.; **c.** 1 gal. 1 pt.; **d.** 1 doz. and 3; **e.** 2 lb. 4 oz.

2. How much ice cream was used at the picnic? Mrs. Burke bought 3 gal. She took home 1 gal. and 3 quarts.

Sample: 1 gal. 3 qt. $= 1\frac{3}{4}$ gal. $3 - 1\frac{3}{4} = ?$

3. How much ribbon will Beth have left? She now has 5 yd. She is wrapping two packages. Each package takes $1\frac{2}{3}$ yd.

4. When will David need to be home? It is now 2:45 o'clock. His mother says he may be gone $2\frac{1}{2}$ hr.

5. How many dozen doughnuts will be needed for the fifth grade party? Two dozen and 6 will be needed for Miss Kelly's room and 2 dozen and 9 for Mrs. Gray's room.

6. Patricia's mother bought 2 lb. 4 oz. of hamburger and 1 lb. 8 oz. of weiners. How much meat is that?

7. When must the class start on its trip to the city library? The trip will take $1\frac{1}{2}$ hr. The class must be back by a quarter past three o'clock.

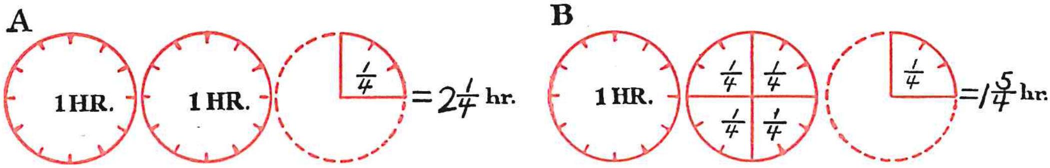
8. When will Chuck's dad be back? He is leaving at 9:45 A.M. He says it will take about $1\frac{1}{2}$ hr. to grease the car and 45 min. more to shop, including time to go and to return.

9. It takes $\frac{3}{4}$ hr. to go to town and the same time to return. Jim's music lesson at 4:00 is $\frac{1}{2}$ hr. long. When does Jim need to start to town? When will he get home?

10. How long did it take to go to Boston? Sam and his mother left home at a quarter to 8 and arrived at 9:30.

CHANGING A ONE TO MAKE SUBTRACTION EASIER

1. How long can Harold play at Jim's house? Harold must be back home in $2\frac{1}{4}$ hours. It takes $\frac{3}{4}$ hr. to ride to Jim's and back.



$$\begin{array}{r} 2\frac{1}{4} \\ -\frac{3}{4} \\ \hline \end{array}$$

How to subtract $\frac{3}{4}$ from $\frac{1}{4}$ puzzled Harold.

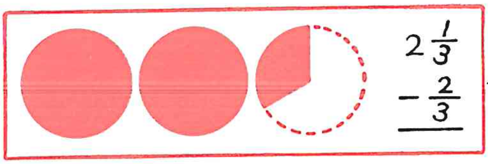
A shows $2\frac{1}{4}$ hr. *B* shows the same, but one of the hours has been changed to fourths.

In *B*, $2\frac{1}{4}$ is the same as $1 + \frac{4}{4} + \frac{1}{4}$.

The circles stand for hours. If you take 3 quarters from *B*, what will be left?

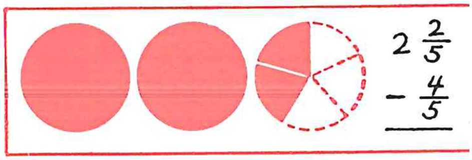
$$\begin{array}{rcl} 2\frac{1}{4} & = & 1\frac{5}{4} \\ -\frac{3}{4} & = & -\frac{3}{4} \\ \hline & & 1\frac{2}{4} = 1\frac{1}{2} \text{ hr.} \end{array}$$

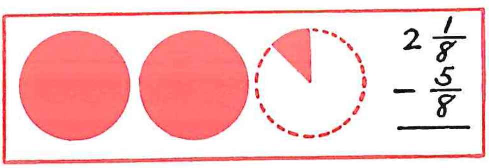
2. Use paper circles or a flannel board to show how the subtractions below are made. Change a one each time.



A

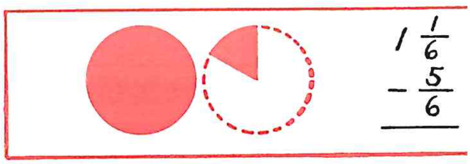
B





C

D



How many thirds will you see in *A* after you change a one to thirds?

How many fifths in *B*? eighths in *C*? sixths in *D*?

3. Find the answers for *A*, *B*, *C*, and *D*.

▶ NO FRACTION LEFT

1. Ruth asked the grocer for a half-pound bag of peanuts. "I have only 2 quarter-pound bags left. You may have them for the same price," he said. Ruth took a half pound of them. Did the grocer have any left?

2. $\begin{array}{r} \frac{5}{6} \\ -\frac{5}{6} \\ \hline \end{array}$ **3.** $\begin{array}{r} 1\frac{3}{4} \\ -\frac{3}{4} \\ \hline \end{array}$ **4.** $\begin{array}{r} 3\frac{4}{5} \\ -1\frac{4}{5} \\ \hline \end{array}$ **5.** $\begin{array}{r} 3\frac{1}{6} \\ -3\frac{1}{6} \\ \hline \end{array}$ **6.** $\begin{array}{r} 1\frac{3}{6} \\ -\frac{1}{2} \\ \hline \end{array}$ **7.** $\begin{array}{r} 3\frac{6}{8} \\ -1\frac{3}{4} \\ \hline \end{array}$

PRACTICE IN CHANGING A ONE IN SUBTRACTION

Subtract these examples. Change a one to an improper fraction as you did on page 230.

1. $\begin{array}{r} 2\frac{1}{5} \\ \frac{4}{5} \\ \hline \end{array}$ **2.** $\begin{array}{r} 3\frac{1}{3} \\ \frac{2}{3} \\ \hline \end{array}$ **3.** $\begin{array}{r} 4\frac{2}{5} \\ \frac{3}{5} \\ \hline \end{array}$ **4.** $\begin{array}{r} 1\frac{1}{4} \\ \frac{3}{4} \\ \hline \end{array}$ **5.** $\begin{array}{r} 2\frac{1}{6} \\ \frac{5}{6} \\ \hline \end{array}$ **6.** $\begin{array}{r} 1\frac{3}{10} \\ \frac{7}{10} \\ \hline \end{array}$

Subtract. Change a one only when needed.

7. $\begin{array}{r} 4\frac{3}{8} \\ \frac{1}{8} \\ \hline \end{array}$ **8.** $\begin{array}{r} 3\frac{3}{4} \\ \frac{1}{2} \\ \hline \end{array}$ **9.** $\begin{array}{r} 2\frac{3}{5} \\ \frac{4}{5} \\ \hline \end{array}$ **10.** $\begin{array}{r} 1\frac{5}{6} \\ \frac{2}{3} \\ \hline \end{array}$ **11.** $\begin{array}{r} 3\frac{7}{10} \\ \frac{8}{10} \\ \hline \end{array}$ **12.** $\begin{array}{r} 2\frac{1}{5} \\ \frac{2}{5} \\ \hline \end{array}$

MIXED PRACTICE

Copy and work. Reduce answers to lowest terms.

1. $\frac{1}{5} + \frac{2}{5}$
2. $\frac{1}{8} + \frac{3}{8}$
3. $\frac{3}{5} - \frac{1}{5}$
4. $\frac{3}{8} - \frac{3}{8}$
5. $\frac{7}{8} + \frac{5}{8}$
6. $\frac{3}{4} - \frac{1}{4}$
7. $\frac{5}{8} - \frac{1}{4}$
8. $1\frac{2}{5} + \frac{2}{5}$
9. $2\frac{1}{4} + \frac{3}{4}$
10. $2\frac{1}{4} - 1\frac{1}{8}$
11. $3\frac{2}{3} - 2\frac{1}{6}$
12. $1\frac{2}{3} + 2\frac{2}{3}$
13. $1 - \frac{1}{5}$
14. $1\frac{1}{4} + \frac{1}{2}$
15. $3\frac{2}{5} - 1\frac{4}{5}$
16. $2\frac{3}{4} + \frac{1}{2}$
17. $4\frac{3}{8} + \frac{7}{8}$
18. $2\frac{1}{4} - 1\frac{3}{4}$
19. $2\frac{3}{8} - 1\frac{7}{8}$
20. $3\frac{1}{2} + 2\frac{3}{8}$
21. $2\frac{5}{6} - 1\frac{5}{6}$
22. $3\frac{9}{10} - \frac{3}{10}$
23. $2\frac{3}{4} + 1\frac{5}{8}$
24. $3\frac{1}{2} + 2\frac{7}{8}$

PRACTICE IN DIVISION

$$
\begin{array}{r}
\checkmark\checkmark \\
23\overline{)483}
\end{array}
\qquad
\begin{array}{r}
\overset{\checkmark\checkmark}{21} \\
23\overline{)483} \\
\underline{46} \\
23
\end{array}
$$

In the examples on this page, estimate the number of digits in the answer before you divide. Copy the example and check where you believe the answer digits should be placed. (See the checks in the sample. Were the checks placed correctly in the sample?)

Set 1

Check the places of the quotient digits, and then divide:

1. $3\overline{)1491}$	**2.** $8\overline{)2440}$	**3.** $5\overline{)2030}$	**4.** $7\overline{)651}$
5. $6\overline{)2874}$	**6.** $9\overline{)963}$	**7.** $4\overline{)344}$	**8.** $8\overline{)5464}$
9. $7\overline{)4399}$	**10.** $5\overline{)3975}$	**11.** $8\overline{)6860}$	**12.** $9\overline{)3231}$
13. $4\overline{)3900}$	**14.** $7\overline{)4228}$	**15.** $9\overline{)3573}$	**16.** $6\overline{)5100}$

Set 2

Check the places of the quotient digits, and then divide:

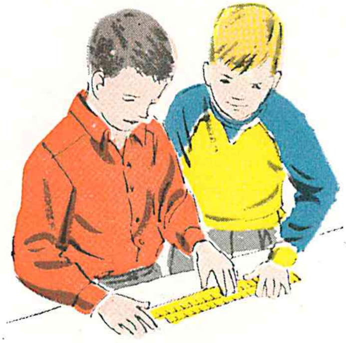
1. $30\overline{)90}$	**2.** $42\overline{)2100}$	**3.** $80\overline{)160}$	**4.** $200\overline{)800}$
5. $64\overline{)320}$	**6.** $7\overline{)560}$	**7.** $20\overline{)4020}$	**8.** $6\overline{)2406}$
9. $5\overline{)5010}$	**10.** $9\overline{)81}$	**11.** $400\overline{)8400}$	**12.** $85\overline{)5100}$
13. $75\overline{)600}$	**14.** $5\overline{)750}$	**15.** $90\overline{)6300}$	**16.** $70\overline{)4970}$

Set 3

Divide. Multiply to check your answers.

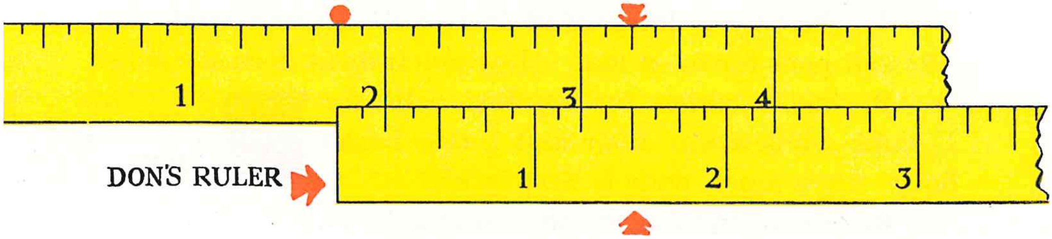
1. $35\overline{)1050}$	**2.** $64\overline{)1216}$	**3.** $47\overline{)235}$	**4.** $73\overline{)99864}$
5. $86\overline{)7740}$	**6.** $59\overline{)2655}$	**7.** $97\overline{)6596}$	**8.** $46\overline{)16560}$
9. $75\overline{)3600}$	**10.** $98\overline{)5586}$	**11.** $64\overline{)4480}$	**12.** $89\overline{)14863}$

PRACTICE



Don and Carl have discovered how to use rulers as an adding machine for fractions. They can add and subtract.

Don wants to take $1\frac{1}{2}$ from $3\frac{1}{4}$. He finds $1\frac{1}{2}$ on his ruler and matches it with $3\frac{1}{4}$ on another ruler. See the arrows. Then he reads the answer at the end of his ruler. See the dot.



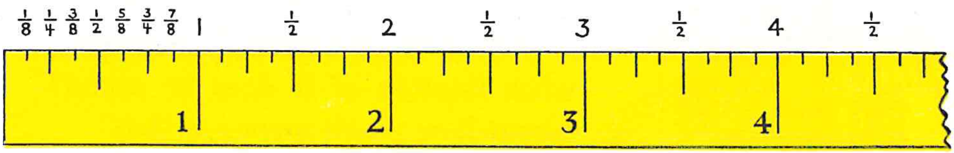
His machine tells him that $3\frac{1}{4} - 1\frac{1}{2} = 1\frac{3}{4}$. Add $1\frac{1}{2}$ and $1\frac{3}{4}$ to check.

$$\begin{array}{rcr} 3\frac{1}{4} & = & 2\frac{5}{4} \\ -1\frac{1}{2} & = & 1\frac{2}{4} \\ \hline & & 1\frac{3}{4} \end{array}$$

Add $1\frac{3}{4}$ and $1\frac{3}{8}$. The machine is already set at $1\frac{3}{4}$. Find $1\frac{3}{8}$ on Don's ruler. Read the answer. Is it $3\frac{1}{8}$?

Use your ruler and the ruler below to do these examples. The numbers above the ruler make it easier to read. Check your answers by using pencil and paper.

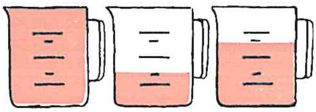
1. $1\frac{1}{4} + 2\frac{1}{2}$	**5.** $1\frac{1}{2} + 1\frac{3}{4}$	**9.** $2 - 1\frac{1}{4}$	**13.** $3 - \frac{5}{8}$
2. $1\frac{1}{8} + 1\frac{3}{8}$	**6.** $1\frac{3}{8} + 2\frac{5}{8}$	**10.** $1\frac{5}{8} - \frac{1}{2}$	**14.** $2\frac{3}{4} - 1\frac{3}{8}$
3. $2\frac{1}{8} + 1\frac{3}{4}$	**7.** $1\frac{1}{4} + \frac{7}{8}$	**11.** $3\frac{5}{8} - \frac{7}{8}$	**15.** $3\frac{3}{4} - 1\frac{1}{2}$
4. $1\frac{1}{2} + 2\frac{1}{8}$	**8.** $\frac{3}{4} + 1\frac{1}{4}$	**12.** $2\frac{3}{4} - \frac{1}{2}$	**16.** $2\frac{1}{4} - 1\frac{1}{8}$



PROBLEMS WITH FRACTIONS

Jane is planning to cook dinner for the family.

1. She buys $\frac{3}{4}$ lb. ground beef, $\frac{1}{2}$ lb. ground veal, and $\frac{1}{4}$ lb. salt pork for meat loaf. How much meat does she buy?



2. Jane's recipe for muffins calls for $1\frac{1}{3}$ cups wholewheat flour and $\frac{2}{3}$ cup bread flour. How much flour is that in all?

3. Her recipe for hot chocolate is $1\frac{1}{2}$ ounces chocolate, $\frac{1}{4}$ cup sugar, $1\frac{3}{4}$ cups boiling water, $1\frac{1}{2}$ cups milk, and $\frac{1}{2}$ cup cream. How much of the three liquids does Jane use?

4. Do you think Jane can serve chocolate to 4 people? Will each get a cup of chocolate?

5. Bob works after school.

a. On Monday he worked $1\frac{1}{2}$ hours. On Tuesday he worked $2\frac{3}{4}$ hours. How many hours did he work on both days?

b. On which day did Bob work longer? How much longer?

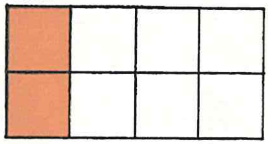
c. Bob's average pay is about \$5.00 a week. He tries to save $\frac{3}{4}$ of it. About how much money does he save each week?

d. If Bob saves $\frac{3}{4}$ of his pay, what fraction of it does he spend? About how much money is that?

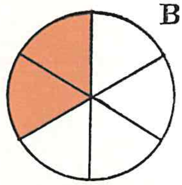
UNIT TEST

Set 1

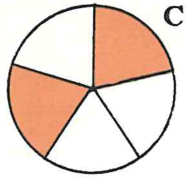
A



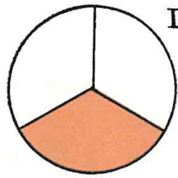
B



C



D



Understanding Fractions

1. What part of *A* is colored?

2. Which two drawings are colored the same amount?

3. Is more of *B* or *C* colored?

4. Which has the smallest fraction colored?

5. Which has the largest fraction colored?

6. Write a fraction with a numerator of 5 and a denominator of 2.

7. How many thirds are in 5?

8. Which is largest? $\frac{1}{3}$ $\frac{1}{4}$ $\frac{1}{8}$ $\frac{1}{10}$

9. Which is smallest? $\frac{1}{8}$ $\frac{1}{10}$ $\frac{1}{2}$ $\frac{1}{6}$

10. Change to lowest terms: **a.** $\frac{2}{4}$ **b.** $\frac{6}{8}$ **c.** $\frac{8}{10}$ **d.** $\frac{12}{16}$

11. Change each to eighths: **a.** $\frac{1}{2}$ **b.** $\frac{1}{4}$ **c.** $\frac{3}{4}$ **d.** $\frac{6}{16}$

12. Arrange in order of size: $\frac{1}{2}$ $\frac{5}{8}$ $\frac{1}{5}$ $\frac{3}{4}$ $\frac{1}{3}$

13. Change to mixed numbers: **a.** $\frac{3}{2}$ **b.** $\frac{5}{3}$ **c.** $\frac{12}{5}$ **d.** $\frac{10}{3}$

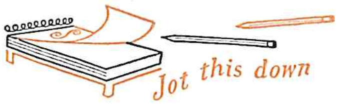
Set 2

Copy these and add:

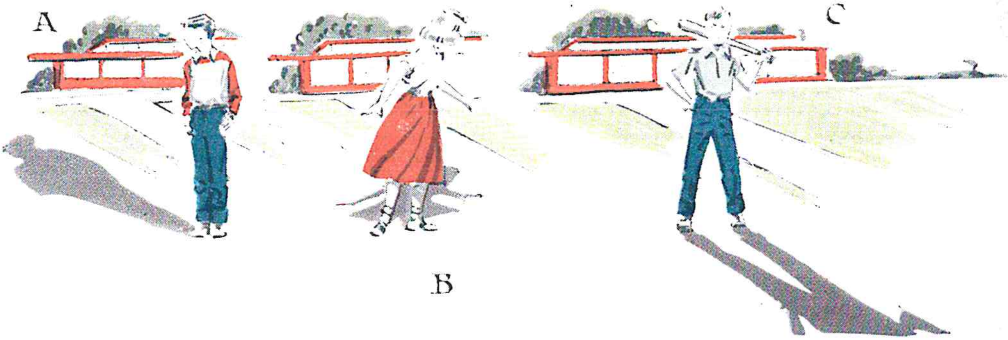
1. $\frac{2}{5}+\frac{1}{5}$	**5.** $\frac{7}{10}+\frac{3}{10}$	**9.** $\frac{3}{5}+\frac{9}{10}$	**13.** $2\frac{1}{8}+3\frac{7}{8}$
2. $\frac{1}{8}+\frac{3}{8}$	**6.** $\frac{1}{4}+\frac{3}{8}$	**10.** $2\frac{3}{4}+1$	**14.** $1\frac{1}{3}+2\frac{1}{6}$
3. $\frac{2}{3}+\frac{2}{3}$	**7.** $\frac{1}{3}+\frac{1}{6}$	**11.** $3\frac{1}{8}+\frac{5}{8}$	**15.** $3\frac{3}{4}+1\frac{5}{8}$
4. $\frac{5}{8}+\frac{7}{8}$	**8.** $\frac{3}{4}+\frac{1}{2}$	**12.** $2\frac{3}{4}+1\frac{3}{4}$	**16.** $1\frac{5}{6}+2\frac{2}{3}$

Copy these and find the answers:

17. $\frac{4}{5}-\frac{2}{5}$	**20.** $1-\frac{2}{3}$	**23.** $\frac{5}{6}-\frac{1}{2}$	**26.** $3\frac{3}{4}-\frac{1}{8}$
18. $\frac{7}{8}-\frac{3}{8}$	**21.** $2\frac{1}{3}-1$	**24.** $2\frac{7}{8}-\frac{1}{2}$	**27.** $2\frac{7}{8}-1\frac{3}{4}$
19. $\frac{3}{5}-\frac{3}{5}$	**22.** $\frac{5}{8}-\frac{1}{4}$	**25.** $3\frac{3}{5}-2\frac{1}{5}$	**28.** $3\frac{5}{6}-1\frac{2}{3}$



Bring a calendar for this year to school.



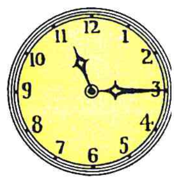
UNIT 16

TIME, WEIGHT, AND TEMPERATURE

READING TIME

1. "Come home at 5 o'clock tonight, Dave," said his mother. If Dave is playing outdoors and has no watch, how can he estimate the time? Which picture above looks like 5 in the afternoon? Which is like noon? Which is 10:30 A.M.?

2. This clock shows 11:15. Is it morning or night? Can you tell? A.M. is from midnight until noon. P.M. is from noon until midnight.



3. How else can you say a quarter past five? a quarter to nine? half past 6? 12:15? 4:30? 3:45?

Number an answer sheet from 4 through 19.

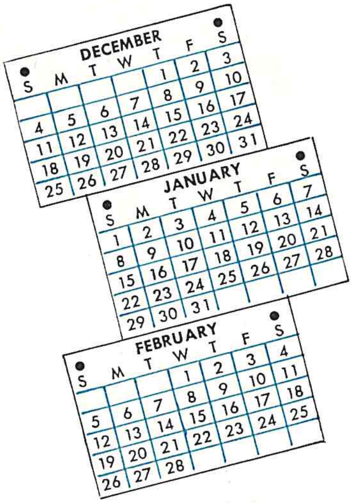
HOW LONG IS IT FROM:

4. 2:00 P.M. to 4:00 P.M.?
5. 10:00 A.M. to 2:00 P.M.?
6. 1:30 P.M. to 4:00 P.M.?
7. 5:30 P.M. to 8:00 P.M.?
8. 9:30 A.M. to 11:45 A.M.?
9. 3:15 P.M. to 5:00 P.M.?
10. 10:30 A.M. to 1:15 P.M.?
11. 7:30 P.M. to 1:00 A.M.?

WHAT TIME WILL IT BE:

12. 2 hr. after 1:30 P.M.?
13. $1\frac{1}{2}$ hr. after 2 P.M.?
14. 1 hr. 20 min. after 4 P.M.?
15. 3 hr. after 10 A.M.?
16. $1\frac{1}{2}$ hr. after 3:15 P.M.?
17. 2 hr. after 3:20 P.M.?
18. 4 hr. after 9:30 A.M.?
19. 5 hr. after 8:30 P.M.?

READING DATES



A clock shows the time of day. A calendar shows the time of year. Do you know how a year is related to the sun?

The four seasons are *times* of the year. Name them.

What is the meaning of yearly? monthly? weekly? daily? hourly?

Do you know these facts?

1 year (yr.) = 365 days (da.)
1 year (yr.) = 52 weeks (wk.) and 1 da.
1 leap yr. = 366 da.
1 yr. = 12 mo.
1 mo. = 31, 30, 29 or 28 da.

1 wk. = 7 da.
1 da. = 24 hr.
1 hr. = 60 min.
1 min. = 60 sec.

Use a calendar for this year to answer these questions. Write the answers on an answer sheet.

1. How many Wednesdays are there in December of this year?

2. Does any month have 5 Mondays?

3. On what date is the first Monday in January?

4. On what day of the week is Christmas?

5. Do Christmas and New Year's come on the same day of the week? always?

6. Valentine's day comes on what day of the week?

7. Is this year a leap year?

8. Do December and January always have the same number of days?

9. List the months in order and write the number of days after each. Begin with January.

10. How many weeks is it from Dec. 11 to Jan. 22? From Jan. 4 to Feb. 8?

▶ READING A TIME SCHEDULE

Time P.M.	KTVB Channel 2	KTVR Channel 4	KTVM Channel 7	KTVQ Channel 9
5:00	Cowboys	Baseball	Quiz Show	4-H Clubbers
5:15	Cowboys	News	Our Puppets	Red Cross
5:30	Camera Club	Space Pilot	Hobbies	Music
5:45	Trained Pets	Space Pilot	Story Time	Weather

Can you read train schedules, radio logs and TV programs? What program is on Channel 9 at 5:30? Find Channel 9 in the row of channels. Find 5:30 in the time column. Go down from Channel 9 and across from 5:30. Do you find *Music*?

Where will you find a puppet show? Find *Our Puppets* in the Channel column. Go across from *Our Puppets* to 5:15. Is the puppet show on Channel 7 at 5:15?

What would you like to see at 5:30? Read the four programs in the row with 5:30.

Number an answer sheet. Answer these questions:

1. What is on Channel 7 at 5:30?
2. At what station and time is *Camera Club*?
3. What program at 5:45 started at 5:30?
4. What program follows *Camera Club*, same station?
5. On which Channel is KTVQ?
6. Can you hear all of *Quiz Show*, *Red Cross*, and *Music*?
7. What is at 5:15 on Channel 9?
8. Can you hear all of *Space Pilot* and *Story Time*?
9. Where and when might you get a rainfall report?
10. What are the two half-hour programs?
11. What channel has a report on baseball? When?

THE MEANING OF "OLD" AND "LONG AGO"

1. How old is an old person? an old tree?

2. How old is an old car? an old shoe? an old horse? an old city? an old loaf of bread?

• It *depends* on what you are talking about. *Old* means different amounts of time.

3. "I bought my sweater a *long time ago*," said Lois. "Columbus lived a *long time ago*," said Charles. About how many years is a *long time ago* for Lois? for Charles? Might its meaning change for them?

• The meaning of many terms for measuring depends upon the way they are used.

4. Make a time line 10 inches long.
At 0 inches put 1492. Put this year at 10 inches.
At $2\frac{3}{4}$ in. put 1620. At $6\frac{1}{8}$ in. put 1776.
At $8\frac{5}{8}$ in. write Grandpa. At $9\frac{1}{4}$ in. write Dad.
Write your own name at $9\frac{3}{4}$ in.
"A long time ago" means about how many years?

PRACTICE

	a	b	c	d	e	f
1.	42 4 733	43 645 322	284 30 436	578 986 869	69 685 787	38 799 565
2.	638 448 5129 6697	5576 479 209 5954	7459 869 5787 8077	647 3677 65 5948	348 7689 436 6858	759 5986 7074 8637

Subtract:

	a	b	c	d	e	f
3.	400 346	1103 907	4002 3995	2160 1470	6150 5398	5014 4558

TEMPERATURE OF THE AIR

How **warm** something is, is **temperature.** How **cold** it is, is also **temperature.**

The temperature of the air is taken in the shade.

AN EXPERIMENT

Material: A liquid thermometer.

1. Read the thermometer in the shade.

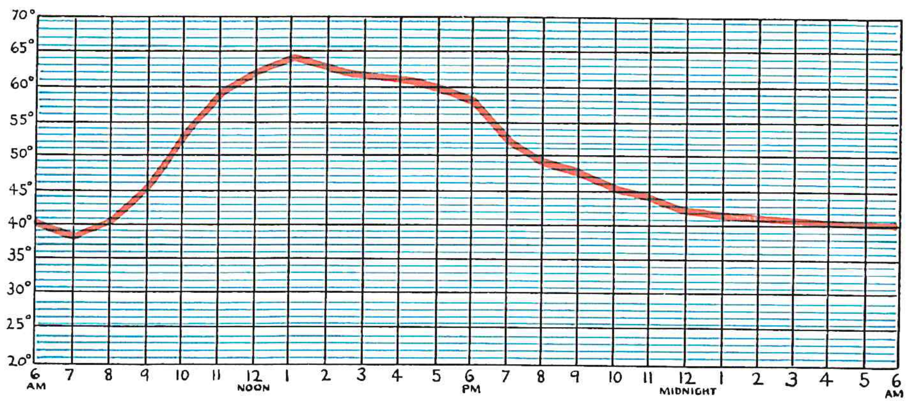
2. Blow on the bulb a while. Read the thermometer.

3. Watch it cool a few seconds.

4. Hold it in the sun. Be very careful. Don't let it reach 100° or it may go higher and break, even if you take it out of the sun. Read it.

5. Place it in water from a faucet or well. Watch the temperature decrease. Dry the thermometer.

HOURLY TEMPERATURE FOR ONE DAY IN APRIL



Write the answers. (The sign ° means degrees.)

6. What was the temperature at 2 A.M.? 7 A.M.? 10 A.M.? 7 P.M.? 9 P.M.? Noon?

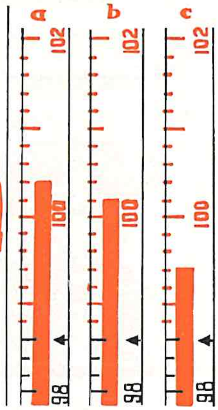
7. At what hour A.M. was it about 42°?

8. At what hour was it hottest? coldest?

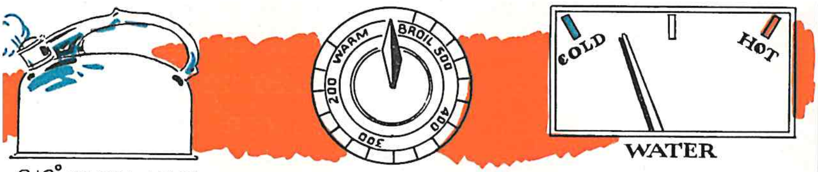
OTHER TEMPERATURES

1. How high can you make a thermometer read by blowing on it? Can it ever be warmer than your body? Your body averages about $98\frac{3}{5}°$. Your temperature varies, that is, it changes from time to time.

2. Read these temperatures. →



3. Tell about each of these pictures:



212° AT SEA LEVEL **B.** **C.**

PRACTICE

Number an answer sheet from 1 through 18. How many degrees in temperature is a change from:

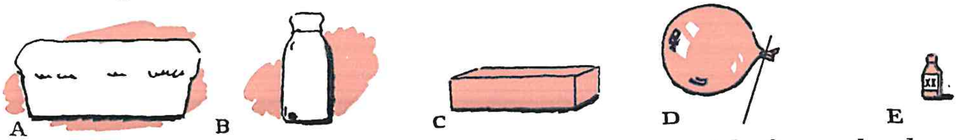
1. 98° to $101\frac{4}{5}°$?	**10.** $101\frac{1}{5}°$ to $99\frac{2}{5}°$?
2. 99° to 100°?	**11.** 70° to 81°?
3. 97° to $98\frac{3}{5}°$?	**12.** 60° to 45°?
4. 100° to $98\frac{3}{5}°$?	**13.** 40° to freezing?
5. 102° to $100\frac{1}{5}°$?	**14.** freezing to 20°?
6. 101° to $98\frac{3}{5}°$?	**15.** freezing to 0°?
7. 98° to $102\frac{3}{5}°$?	**16.** 16° to 0°?
8. 98° to $103\frac{1}{5}°$?	**17.** −10° (below) to 0°
9. 102° to $98\frac{4}{5}°$?	**18.** 0° to −12°?

Now mark each change on your answer sheet with a **w** for warmer and a **c** for colder.

How much is a change from 20° above zero to 5° below zero? from 40° to 10° below freezing?

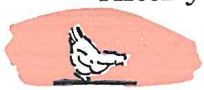
HOW MUCH COMMON THINGS WEIGH

1. Write your estimate of the weight of each of these things on an answer sheet:

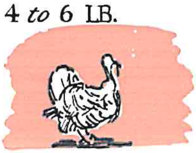


A B C D E

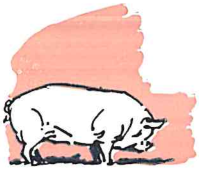
After you have written your answers, not before, check with the answers at the bottom of page 246.



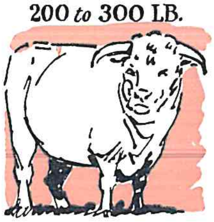
4 *to* 6 LB.



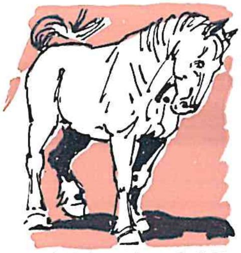
15 *to* 22 LB.



200 *to* 300 LB.



900 *to* 1400 LB.



1000 *to* 1600 LB.

2. An interesting experiment is to put sand into paper milk cartons and weigh them. Then other children can lift them and estimate the weights.

3. Use the scales in your room, or ones you bring, to weigh books, paper, chalk, packages, and other things. Always estimate the weights first.

Most full-grown animals will weigh between the pounds shown under the pictures.

PRACTICE

Change to ounces:

1. $\frac{1}{4}$ of 1 lb. **3.** $\frac{1}{8}$ of 1 lb. **5.** $1\frac{1}{2}$ lb. **7.** 3 lb.

2. $\frac{1}{2}$ of 1 lb. **4.** $\frac{1}{2}$ of 2 lb. **6.** 2 lb. **8.** $2\frac{1}{2}$ lb.

Change to pounds:

9. 24 oz. **11.** 20 oz. **13.** 4 oz. **15.** 2 oz.

10. 32 oz. **12.** 8 oz. **14.** 12 oz. **16.** 10 oz.

Add:

17. $2\frac{1}{2}$ lb. + $\frac{1}{2}$ lb. **20.** $1\frac{1}{2}$ lb. + $1\frac{1}{4}$ lb.

18. $2\frac{1}{4}$ lb. + $\frac{3}{4}$ lb. **21.** $1\frac{1}{4}$ lb. + $1\frac{3}{8}$ lb.

19. 1 lb. + $2\frac{3}{4}$ lb. **22.** $3\frac{3}{4}$ lb. + $2\frac{1}{2}$ lb.

Is a ton of bricks heavier than a ton of cotton?

FEEDING A HORSE

Martha spent the summer on her uncle's ranch. He had a pony for the children and a riding horse for adults.

Martha liked to feed the pony. She measured oats with a peck measure and fed about 2 quarts at a time.

1. How many quarts are there in a bushel? 1 bushel (bu.) = 4 pecks (pk.). 1 peck = 8 quarts.

2. Bob is going with Uncle Dave to buy 2 tons of hay. A ton (T.) weighs 2000 lb. The bales he will buy will average about 80 lb. How many bales will he get?

3. How much does it cost for oats to feed a horse a day? He eats a peck of oats. Oats cost 80¢ a bushel at the ranch. Write the unseen question for which you need an answer.

4. A very, very big horse may weigh a ton. A riding horse weighs nearer a half ton. How many pounds is a half ton?

5. If a bushel of potatoes weighs 56 lb., how heavy is a peck of potatoes?

6. If a bushel of peaches weighs 60 lb., how many pounds does a peck weigh?

A lug of peaches weighs 20 to 25 lb. A lug is a box about 14 in. wide by 16 in. long. It usually has 2 layers of big peaches, but it may be full of little peaches.

John says, "I can lug a lug, but I can't lug a bushel." What does he mean? Use your dictionary.

PROBLEM SOLVING

Problems without numbers. Tell how to solve them.

1. You know how many children belong in your room at school. You read on the chalkboard how many are absent today. How many are here today?

2. How far over the mountain is it to Brookdale? You know how far it is to the top of the mountain from here and from the top down to Brookdale.

Problems that need more facts. What facts are needed?

3. How far will Ann ride her bicycle in 2 hours? On what does the answer depend?

4. How much change should Bill get back from a dollar if he pays for 2 hamburgers? On what does the answer depend?

Two-step problems. What is the unseen question?

5. How much change should Jane get back? She gave the clerk $1 to buy 3 boxes of paper handkerchiefs at 15¢ a box.

6. How much will 24 doughnuts cost if a package of a half-dozen costs 20¢?

Make a picture of Problem 7:

7. How many glasses of milk can be poured from 2 quarts if a glass is a half pint?

Make a problem of your own:

8. About sharing the cost of a party with some friends.

9. About buying something you want.

10. About earning some money.

CARRY FACTS

Use an answer strip as your teacher reads these questions:

(1)
8 sixes + 7
9 sevens + 8
3 sixes + 2
4 sevens + 3
9 nines + 8
7 eights + 6
9 sixes + 8
8 eights + 7
9 threes + 6

(10)
7 sevens + 6
8 fives + 3
9 sixes + 6
7 fives + 6
8 sixes + 6
9 fours + 8
6 threes + 4
8 sevens + 7
9 threes + 8

(19)
7 sevens + 4
9 sevens + 7
4 fours + 3
7 eights + 5
9 fives + 8
6 sixes + 4
7 fours + 5
9 fives + 7
7 sevens + 5

GROWTH TEST

1. Multiply 908 by 30.
2. $\frac{5}{8} + \frac{1}{8} =$?
3. What is the sum of 39, 1086, and 596?
4. Divide 2025 by 30.
5. $6\frac{3}{4} - 4\frac{1}{2} =$?
6. Subtract 1650 from 2634.
7. What is the product of 879 and 74?
8. Add $3\frac{5}{12}$ and $\frac{1}{6}$.
9. Find the average of 67, 86, 134, and 94.
10. Subtract 3 from $7\frac{2}{5}$.
11. 598 from 1547 equals ?.
12. $\frac{3}{4}$ of 36 = ?
13. $689 \times 85 =$?
14. $2\frac{3}{4} - \frac{1}{4} =$?
15. $7000 \div 92 =$?
16. 7964 is how many less than 11,500?
17. Find the average of 556, 878, 299, 789, and 994.
18. The sum of $2\frac{1}{3}$ and $\frac{1}{6}$ is ?.
19. Find the product of 780 and 60.
20. Find the difference between $3\frac{1}{2}$ and $1\frac{3}{10}$.

REASONABLE MEASURES

Which answer in each example below will be most nearly correct most of the time? Use an answer sheet.

1. Tom usually walks a mile in: **a.** 2 hr. **b.** 1 hr. **c.** $\frac{1}{2}$ hr.

2. Three months is: **a.** 60 da. **b.** 90 da. **c.** 100 da.

3. If Christmas comes on Tuesday, New Year's comes on: **a.** Tuesday **b.** Friday **c.** Saturday

4. A hot day in the desert would be about:
a. 90° **b.** 115° **c.** 145°

5. A cold blizzard might be about:
a. 20 degrees below zero **b.** 32° **c.** 45°

6. The first hour after sunrise, the temperature rose:
a. 8° **b.** 38° **c.** 68°

7. The meat in a hamburger weighed: **a.** 3 oz. **b.** 8 oz. **c.** 1 lb.

8. Five bananas weighed: **a.** 3 oz. **b.** 8 oz. **c.** 2 lb.

9. Three apples weighed: **a.** 1 lb. **b.** 3 lb. **c.** 5 lb.

10. The water in the car radiator when the engine is running is usually nearest: **a.** 160° **b.** 212° **c.** 298°

11. A hammer for nails weighs about: **a.** 1 lb. **b.** 5 lb. **c.** 10 lb.

12. A gallon of water weighs about: **a.** 2 lb. **b.** 8 lb.

13. This book weighs: **a.** 8 oz. **b.** $1\frac{1}{2}$ lb. **c.** $4\frac{1}{2}$ lb.

Answers for Problem 1, page 242.

Loaves of bread usually weigh 16 to 24 ounces.

A pint of milk or water weighs just a little more than 1 pound. "A pint's a pound, the world round," is an old saying.

A brick 8 by $2\frac{1}{4}$ by $3\frac{3}{4}$ inches weighs about 4 lb.

A small toy balloon weighs about 1 ounce.

A small bottle of iodine, or merthiolate, may weigh about 1 or 2 oz.

UNIT PROBLEMS TEST

1. Sally went to play with Doris. She left at 3:45 P.M., and is to be back in $1\frac{1}{2}$ hr. from then. What time will that be?

2. John left at 3:15 P.M. and returned at 4:30 P.M. How long was he gone?

3. Eight months from October 15 will be:

a. June 15 **b.** April 15 **c.** March 15 **d.** May 15

4. Is a July day in Ohio nearer 28°, 85°, or 120°?

5. Four hours ago the temperature was 8° below freezing. It is now 12° above freezing. What is it now? How many degrees did the temperature change?

6. How many pecks are there in $2\frac{1}{4}$ bushels?

UNIT TEST

Number an answer sheet 1–17.

How long is it from:

1. 3:00 P.M. to 5:30 P.M.?

2. 10:00 A.M. to 2:30 P.M.?

3. 4:45 P.M. to 6:30 P.M.?

What time will it be:

4. $2\frac{1}{2}$ hr. from 3:00 P.M.?

5. $1\frac{1}{4}$ hr. from 2:15 P.M.?

6. 1 hr. from 2:45 P.M.?

How many degrees in temperature is a change from:

7. 16° to 40°?

8. 32° to 50°?

9. $-10°$ to 20°?

10. freezing to 40°?

11. 8° to freezing?

12. 0° to freezing?

13. $100\frac{3}{5}°$ to $102\frac{4}{5}°$?

14. $98\frac{2}{5}°$ to $101\frac{4}{5}°$?

15. $99\frac{4}{5}°$ to $100\frac{2}{5}°$?

16. Change these measures:

a. $\frac{1}{2}$ of 1 lb. = ? oz.

b. $\frac{1}{8}$ of 1 lb. = ? oz.

c. $\frac{3}{4}$ of 1 lb. = ? oz.

d. $1\frac{1}{4}$ lb. = ? oz.

e. 8 oz. = ? lb.

f. 4 oz. = ? lb.

g. 32 oz. = ? lb.

h. 24 oz. = ? lb.

17. Add:

a. $2\frac{1}{4}$ lb. + $1\frac{3}{4}$ lb.

b. $2\frac{1}{2}$ lb. + $2\frac{1}{4}$ lb.

c. $1\frac{3}{4}$ lb. + $2\frac{1}{2}$ lb.

d. 8 oz. + $2\frac{3}{4}$ lb.

UNIT 17

FINDING QUOTIENT DIGITS

● *The correct quotient digit is not always the one you see.*

25)40 ← **1.** There are 40 books about pioneers to be shared by 25 children. Esther writes the division. She sees 4 to be divided by 2. She knows there cannot be 2 books for each child because 2 × 25 is 50. She says the answer will be 1 book each and 15 extras to be shared some way.

25)60 ← **2.** Sandra wants to change 60¢ for quarters. She writes the division. Sandra sees 6 tens divided by 2 tens, but she knows there can't be 3 quarters. How?

$$\begin{array}{r} 4 \\ 25\overline{)84} \\ 100 \end{array}$$

3. Joe's class is helping with the school carnival. Joe's mother will bake 7 dozen cookies. Her cooky pan holds 25. How many pans must she bake?

Joe sees 4 twos in 8. So he divides that way.

He sees that he cannot subtract 100 from 84.

$$\begin{array}{r} 3 \\ 25\overline{)84} \\ \underline{75} \\ 9 \end{array}$$

"If there are not 4 × 25 in 84, I'll try 3," says Joe. 3 × 25 = 75. Three pans will make 75 cookies. How many more cookies are needed?

4. How can you tell which of the two quotient digits in **a**, in **b**, and in **c** is the correct one?

a. $\begin{array}{r} 3 \\ 24\overline{)65} \\ \underline{72} \end{array}$ or $\begin{array}{r} 2 \\ 24\overline{)65} \\ \underline{48} \end{array}$

b. $\begin{array}{r} 6 \\ 45\overline{)248} \\ \underline{270} \end{array}$ or $\begin{array}{r} 5 \\ 45\overline{)248} \\ \underline{225} \end{array}$

c. $\begin{array}{r} 4 \\ 36\overline{)136} \\ \underline{144} \end{array}$ or $\begin{array}{r} 3 \\ 36\overline{)136} \\ \underline{108} \end{array}$

JUDGING THE QUOTIENT DIGIT

1. Some of these examples must be started again. How can you tell which ones have not been started correctly by comparing two numbers?

a. $\begin{array}{r} 3 \\ 48\overline{)175} \\ \underline{144} \end{array}$	**b.** $\begin{array}{r} 5 \\ 56\overline{)260} \\ \underline{280} \end{array}$	**c.** $\begin{array}{r} 7 \\ 35\overline{)225} \\ \underline{245} \end{array}$	**d.** $\begin{array}{r} 4 \\ 66\overline{)264} \\ \underline{264} \end{array}$	**e.** $\begin{array}{r} 6 \\ 38\overline{)200} \\ \underline{228} \end{array}$

2. There are two subtractions in division **f.** Read them.

3. There are two subtractions in **g.** One of them is done correctly. The other one shows that the quotient digit used was too large. Read the correct one. Read the one that is not correct. Try 5 as a quotient digit instead of 6.

f. $\begin{array}{r} 23 \\ 24\overline{)558} \\ \underline{48} \\ 78 \\ \underline{72} \\ 6 \end{array}$ **g.** $\begin{array}{r} 36 \\ 25\overline{)885} \\ \underline{75} \\ 135 \\ \underline{150} \end{array}$

4. Read all the numbers in **f** and **g** that are used as subtrahends; as minuends.

Can you make a rule about the sizes of the subtrahends and minuends in the subtraction parts of a division example? Try it.

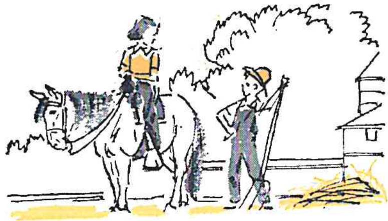
5. Try your rule with these divisions. Which of the quotient digits shown should be changed? How?

a. $\begin{array}{r} 5 \\ 36\overline{)180} \end{array}$	**d.** $\begin{array}{r} 4 \\ 48\overline{)134} \end{array}$	**g.** $\begin{array}{r} 7 \\ 35\overline{)235} \end{array}$	**j.** $\begin{array}{r} 3 \\ 65\overline{)215} \end{array}$	**m.** $\begin{array}{r} 5 \\ 44\overline{)230} \end{array}$
b. $\begin{array}{r} 6 \\ 24\overline{)124} \end{array}$	**e.** $\begin{array}{r} 4 \\ 38\overline{)158} \end{array}$	**h.** $\begin{array}{r} 8 \\ 47\overline{)350} \end{array}$	**k.** $\begin{array}{r} 6 \\ 59\overline{)349} \end{array}$	**n.** $\begin{array}{r} 9 \\ 67\overline{)593} \end{array}$
c. $\begin{array}{r} 6 \\ 25\overline{)134} \end{array}$	**f.** $\begin{array}{r} 9 \\ 52\overline{)498} \end{array}$	**i.** $\begin{array}{r} 3 \\ 39\overline{)100} \end{array}$	**l.** $\begin{array}{r} 4 \\ 28\overline{)98} \end{array}$	**o.** $\begin{array}{r} 7 \\ 55\overline{)375} \end{array}$

• Whenever a subtrahend in the subtraction step in a division is larger than its minuend, try the next smaller digit for the quotient.

WATCHING BOTH SUBTRACTIONS

Helen and Jim live on a farm. Farmers think much about averages. They hardly ever know what any single acre of land produces, or how many eggs any single hen lays, or how much milk each cow gives. But farmers do figure averages.



1. On one day 12 cows produced 33 gallons of milk. What was the average for each cow?

$$\begin{array}{r l} \mathbf{3} & \\ 12\overline{)33} & \leftarrow \text{Compare.} \\ \mathbf{36} & \leftarrow \text{Too large.} \end{array}$$

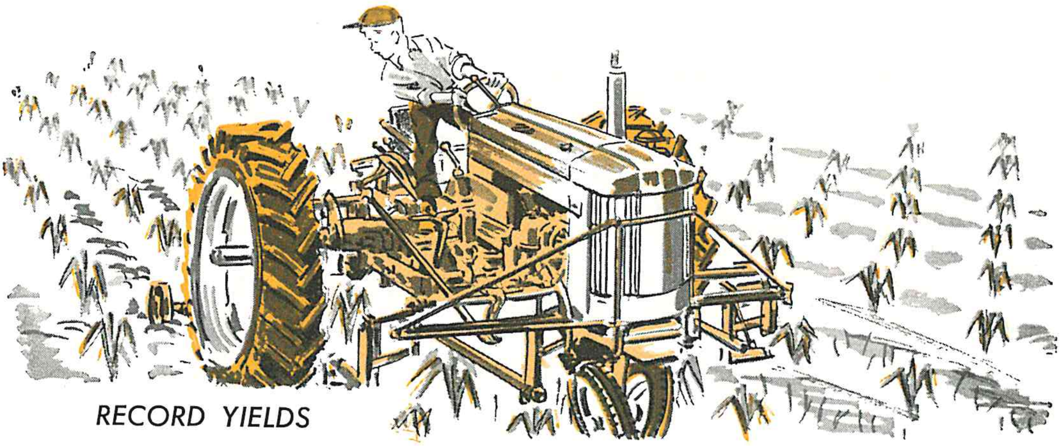
$$\begin{array}{r l} 2 & \\ 12\overline{)33} & \text{Compare again.} \\ \underline{24} & \end{array} \qquad \begin{array}{r} 2\frac{9}{12} = 2\frac{3}{4} \text{ gal.} \\ 12\overline{)33} \\ \underline{24} \\ 9 \end{array}$$

2. A cornfield of 35 acres yielded 1600 bushels of corn. What was the average yield for each acre?

$$\begin{array}{r l} \mathbf{46} & \\ 35\overline{)1600} & \\ \underline{140} & \leftarrow \text{Compare.} \\ 200 & \leftarrow \text{Compare.} \\ \underline{\mathbf{210}} & \leftarrow \text{Too large.} \end{array} \qquad \begin{array}{r l} 45 & \\ 35\overline{)1600} & \\ \underline{140} & \\ 200 & \text{Compare again.} \\ \underline{175} & \end{array} \qquad \begin{array}{r} 45\frac{25}{35} = ? \\ 35\overline{)1600} \\ \underline{140} \\ 200 \\ \underline{175} \\ 25 \end{array}$$

3. Find the averages:

	BUSHELS	ACRES		GALLONS	COWS		EGGS	HENS
a.	885	25	**d.**	894	12	**g.**	1805	95
b.	1656	48	**e.**	1304	24	**h.**	917	38
c.	3675	75	**f.**	485	15	**i.**	5244	76



RECORD YIELDS

Several 4-H Club members had small fields of corn on good soil. Here are their yields:

	BUSHELS	ACRES		BUSHELS	ACRES
Harold	1145	12	Fred	1380	15
Bob	1274	13	Tom	1172	12
Charles	1091	12	Clyde	1027	11
Henry	1017	11	Gordon	939	10
George	1342	14	Lester	1512	16

1. Clyde tried to average his this way. He found that the subtrahend in his subtraction was too big. So he tried 1 less for his first quotient digit. Divide the example correctly.

$$\begin{array}{r} \mathbf{10} \\ 11\overline{)1027} \\ \underline{\mathbf{110}} \end{array}$$

2. Bob looked at his division. He decided to try *12*. Will he be right? Try 9 instead of 12.

$$13\overline{)1274}$$

Can you make a rule that will help Bob?

We have been talking much about the first quotient digit. The one we try is often called the **trial quotient** digit. Is a digit ever two figures? What is the largest digit?

• Nine is the largest *trial quotient* you can ever have.

3. Find the average yield for each boy listed at the top of this page.

4. Which boy had the largest average yield?

THE GOOD JUDGMENT WAY

1. Fifteen children are making May baskets for the first grade. There are 30 sheets of blue paper. How many sheets will there be for each child?

$15\overline{)30} \leftarrow$ Peg wrote the division. "If there were 10 children, each could have 3 sheets," she said. "So, if there are more than 10 children, there will be less than 3 sheets for each. I'll try 2 in the quotient." Was Peg right?

$15\overline{)48} \leftarrow$ **2.** There were 48 sheets of blue paper for the 15 children. Gary said, "It looks as if 4 is the quotient. If I multiply 4×5, I will carry 2. That would make the 4×1 too large. I'll try 3." Is he right?

3. How many will you carry when you multiply in each of these divisions?

a. $\begin{array}{r}7\\12\overline{)75}\end{array}$ **b.** $\begin{array}{r}5\\14\overline{)58}\end{array}$ **c.** $\begin{array}{r}6\\25\overline{)130}\end{array}$ **d.** $\begin{array}{r}4\\36\overline{)135}\end{array}$ **e.** $\begin{array}{r}5\\48\overline{)220}\end{array}$

In **a**, will 7×1 plus the carry digit be more than 7?
In **b**, will 5×1 plus the carry digit be more than 5?
In **c**, will 6×2 plus the carry digit be more than 13?
In **d**, will 4×3 plus the carry digit be more than 13?
In **e**, will 5×4 plus the carry digit be more than 22?

4. Multiply in your head. Which quotients are correct?

a. $\begin{array}{r}8\\12\overline{)88}\end{array}$ **b.** $\begin{array}{r}4\\16\overline{)44}\end{array}$ **c.** $\begin{array}{r}6\\25\overline{)150}\end{array}$ **d.** $\begin{array}{r}5\\37\overline{)165}\end{array}$ **e.** $\begin{array}{r}4\\14\overline{)56}\end{array}$

5. Divide these mentally. Write only the answers.

a. $14\overline{)56}$	**d.** $13\overline{)52}$	**g.** $12\overline{)60}$	**j.** $15\overline{)45}$	**m.** $18\overline{)36}$
b. $16\overline{)48}$	**e.** $14\overline{)42}$	**h.** $13\overline{)39}$	**k.** $12\overline{)48}$	**n.** $16\overline{)32}$
c. $19\overline{)95}$	**f.** $17\overline{)68}$	**i.** $18\overline{)72}$	**l.** $16\overline{)96}$	**o.** $19\overline{)57}$

USING THE GOOD JUDGMENT WAY

1. Jane's father is helping with her garden. He brought home 8 dozen tomato plants. Jane says she will put 16 in each row. How many rows will she have?

a. What are the two questions in this problem?

b. Do you add, subtract, multiply, or divide to answer the first question? What numbers do you use? Do you get 96 plants all together?

c. Finish the problem. Use good judgment.

2. Flower seeds cost 25¢ a packet. How many packets can Jane buy for 85¢? Write all of the division.

3. Is a packet a measure? Do all packets have the same number of seeds? the same weight of seeds?

4. A *packet* of seeds is usually a size that is made to sell for a certain amount of money, as 10¢, 20¢, or 25¢. Which will have more seeds, a 10-cent packet of expensive seeds or a 10-cent packet of cheaper seeds?

5. In 28 days, Jane feeds her chickens 85 lb. of grain. About what is the average number of pounds fed daily?

6. In the same time, Jane's dad feeds his chickens twice as many pounds. About what is the average number of pounds he feeds daily? *Think carefully.*

7. Copy and divide. Is your judgment good enough to try the correct quotient digit the first time?

a. $54\overline{)4644}$	**e.** $84\overline{)5460}$	**i.** $75\overline{)2925}$	**m.** $64\overline{)3072}$
b. $97\overline{)9506}$	**f.** $37\overline{)2368}$	**j.** $57\overline{)4389}$	**n.** $46\overline{)4278}$
c. $96\overline{)3552}$	**g.** $68\overline{)4964}$	**k.** $85\overline{)3910}$	**o.** $53\overline{)5141}$
d. $43\overline{)3225}$	**h.** $98\overline{)7252}$	**l.** $68\overline{)6664}$	**p.** $79\overline{)6004}$

DO YOU REALLY UNDERSTAND DIVISION?

The Problem: Mr. Long, the principal, bought 100 yd. of jumping rope. He asked a committee to cut it into pieces 14 ft. long. How many pieces will there be?

Number an answer sheet and write the answers:

1. Is the above problem a two-question or a one-question problem?

2. Write the first question, if there are two questions. Study the division at the right. →

$$\begin{array}{r} 21 \\ 14\overline{)300} \\ 28 \\ \hline 20 \\ 14 \\ \hline 6 \end{array}$$

3. Write the number which is the dividend. Do you see the number 300 in the problem above?

4. Which number is the divisor?

5. Which numbers are really subtrahends?

6. What digit was *brought down*?

7. How many 14-foot jumping ropes are there?

8. How long is the piece that is left over?

9. How many of the 21 pieces could have been made 15 ft. long by planning to use the remainder?

10. Is 300 a number of feet or yards?

11. Does the 21 tell feet, yards, or pieces?

12. Which two of the numbers do you multiply when you check? Which number do you add when you check?

After you multiply and add to check, what number should you get?

CAN YOU TELL?

1. In $\frac{6}{14}$ which number is the denominator? the numerator?

2. Which number is a dividend in $\frac{6}{14}$? a divisor?

3. Which of these divisions will have the smallest quotient? **a.** $11\overline{)150}$ **b.** $15\overline{)150}$ **c.** $14\overline{)150}$ **d.** $12\overline{)150}$

4. Which division will have a quotient of less than 1?

a. $30\overline{)89}$ **b.** $27\overline{)75}$ **c.** $88\overline{)164}$ **d.** $30\overline{)29}$

MULTIPLICATIONS USED IN DIVISION

The next step in each of the examples below is to multiply. *Do not* copy the examples. Write only the answer to each multiplication. The first answer will be 296, which is 8 × 37.

1. $\begin{array}{r} 8 \\ 37\overline{)328} \end{array}$	**2.** $\begin{array}{r} 5 \\ 68\overline{)363} \end{array}$	**3.** $\begin{array}{r} 9 \\ 89\overline{)845} \end{array}$	**4.** $\begin{array}{r} 8 \\ 58\overline{)486} \end{array}$
5. $\begin{array}{r} 9 \\ 46\overline{)440} \end{array}$	**6.** $\begin{array}{r} 5 \\ 79\overline{)435} \end{array}$	**7.** $\begin{array}{r} 7 \\ 47\overline{)342} \end{array}$	**8.** $\begin{array}{r} 8 \\ 69\overline{)585} \end{array}$
9. $\begin{array}{r} 9 \\ 57\overline{)535} \end{array}$	**10.** $\begin{array}{r} 7 \\ 69\overline{)527} \end{array}$	**11.** $\begin{array}{r} 6 \\ 68\overline{)437} \end{array}$	**12.** $\begin{array}{r} 7 \\ 58\overline{)449} \end{array}$

PRACTICE WITH DIVISION FACTS

Prepare an answer strip for 46 answers. Write the answer the way it is done for Numbers *1* and *2*. The answer for No. *1* means there are 4 threes in 14 and 2 left over.

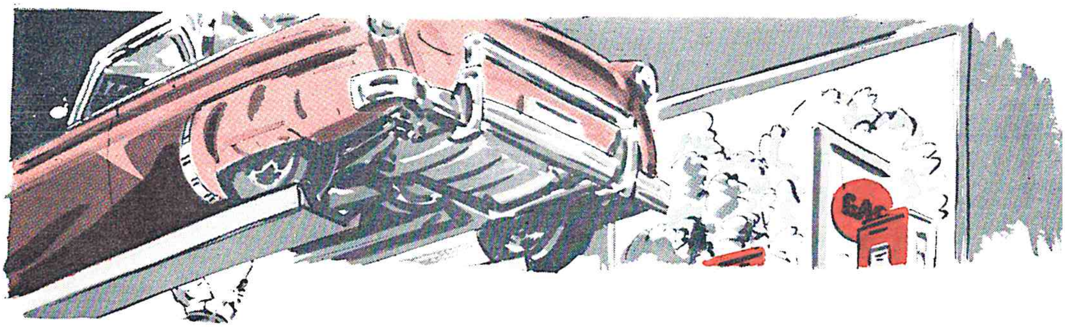
(Teacher: Adjust time to performance of class.)

(1) 3's in 14
4, 2
6's in 31
5, 1
5's in 28
9's in 87
(5) 6's in 23
5's in 19
3's in 23
6's in 27
4's in 21
(10) 9's in 29

5's in 37
4's in 15
9's in 77
8's in 39
(15) 4's in 19
8's in 29
3's in 20
8's in 75
9's in 52
(20) 6's in 41
7's in 33
6's in 52

3's in 26
5's in 43
(25) 9's in 39
5's in 34
4's in 27
8's in 63
3's in 28
(30) 9's in 56
8's in 45
9's in 67
8's in 69
5's in 48

(35) 7's in 40
4's in 30
6's in 46
7's in 54
4's in 39
(40) 7's in 66
7's in 25
4's in 34
7's in 48
8's in 55
(45) 6's in 58
7's in 60



TRY THE GOOD JUDGMENT WAY AGAIN

$$\begin{array}{r} 7 \\ 28\overline{)154} \\ \underline{196} \end{array}$$

1. Frank Hill's dad runs a filling station. During the month of February he greased 154 cars in 28 days. What was his daily average of cars greased?

Frank first tried 7 in the quotient. He compared 196 with 154. Is 7 too large?

$$\begin{array}{r} 6 \\ 28\overline{)154} \\ \underline{168} \end{array}$$

Frank then tried 6. He compared 168 with 154. Still too large. What should Frank do next?

$$\begin{array}{r} 5\frac{14}{28} \\ 28\overline{)154} \\ \underline{140} \\ 14 \end{array}$$

Frank next tried 5. It was correct. Frank finished the division. Did his dad grease an average of $5\frac{1}{2}$ cars a day in February?

2. Could Frank have saved time by making a better judgment? How could he have known that 7 and 6 would be too large without trying them out?

PRACTICE

Copy and divide:

1. $31\overline{)1581}$	**6.** $16\overline{)368}$	**11.** $16\overline{)896}$	**16.** $15\overline{)795}$
2. $22\overline{)770}$	**7.** $15\overline{)360}$	**12.** $96\overline{)4320}$	**17.** $28\overline{)1764}$
3. $64\overline{)2752}$	**8.** $23\overline{)1472}$	**13.** $58\overline{)2900}$	**18.** $38\overline{)2166}$
4. $12\overline{)384}$	**9.** $46\overline{)3220}$	**14.** $27\overline{)1593}$	**19.** $26\overline{)1274}$
5. $83\overline{)6308}$	**10.** $87\overline{)2958}$	**15.** $85\overline{)4080}$	**20.** $29\overline{)1421}$

NUMBERS WITH LETTERS

1. Marilyn telephones her mother when they are to meet after school. She calls H 4–6274. This number will get her mother's telephone, but no other telephone.

Different letters are used in telephone numbers for different parts of a city.

How many letters are there in the alphabet?

How many digits are there in our number system? Why do we use letters in automobile numbers?

Letters help to make more numbers.

2. Sometimes letters are used on automobile plates and in similar places.

Automobile license plates use letters to keep the plates short.

3. Sometimes numbers are used to tell the order in which things come. You might come first, second, or even eighth in a line. Here are short ways to write ordinal numbers. (**Ordinals** tell the **order.**)

first	1st	fourth	4th	seventh	7th	tenth	10th
second	2nd	fifth	5th	eighth	8th	eleventh	11th
third	3rd	sixth	6th	ninth	9th	twelfth	12th

Streets are often named by numbers, as 3rd St., 16th St.

Can you make more than 99 auto numbers with one letter and one digit in each? Do not use zero.

A1, A2, A3, A4, A5, A6, A7, A8, A9
B1, B2, B3, B4, B5, B6, B7, B8, B9
C1, and so on.

NUMBER PROCESSES IN DIVISION

When you work with numbers, you use addition, subtraction, multiplication, or division. These are called **number processes.**

Have you discovered that sometimes when you are doing division you use three other number processes too?

Study the steps in the example below:

$$\begin{array}{r} 34\frac{5}{35} = 34\frac{1}{7} \\ 35\overline{)1195} \\ \underline{105} \\ 145 \\ \underline{140} \\ 5 \end{array}$$

1. First you find the quotient digit. Did you use *division?*

2. Is the next step *multiplication?* Did you need to use *addition* too? How?

3. Is the next step *subtraction?*

4. Tell how you use the number processes in finishing the example.

5. Do you think that knowing addition, subtraction, and multiplication helps you with division?

PRACTICE

Copy and subtract the examples. Be sure to ask questions if there are examples you don't understand.

1. 183 138	**2.** 260 232	**3.** 405 348	**4.** 351 308	**5.** 570 504
6. 409 378	**7.** 300 258	**8.** 414 364	**9.** 364 329	**10.** 209 189
11. 211 162	**12.** 623 546	**13.** 454 390	**14.** 710 648	**15.** 320 297

COMPARING BY DIVISION

1. Bill has 18 marbles. Jim has 6. Does Bill have 3 times as many marbles as Jim?

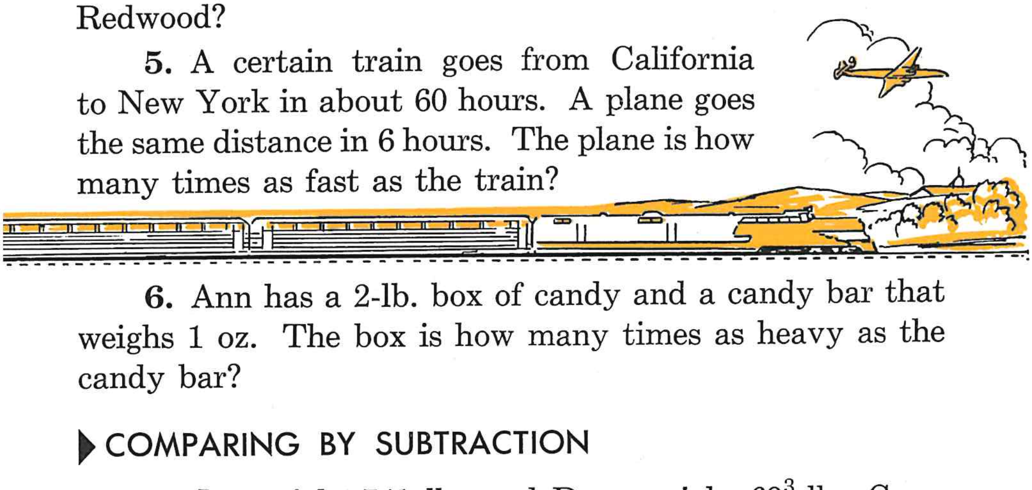
Use a fraction to compare Jim's number of marbles with Bill's.

2. Sue's allowance is one dollar a week. Her little sister's allowance is a quarter a week. Sue gets how many times as much for her allowance as her sister gets?

3. Jerry went on a trip with his mother. On the first day they drove 25 miles. On the next day they drove 200 miles. How many times as far did they drive the second day?

4. Carol City has 20 thousand people. Redwood has 4 thousand. Carol City is how many times as large as Redwood?

5. A certain train goes from California to New York in about 60 hours. A plane goes the same distance in 6 hours. The plane is how many times as fast as the train?



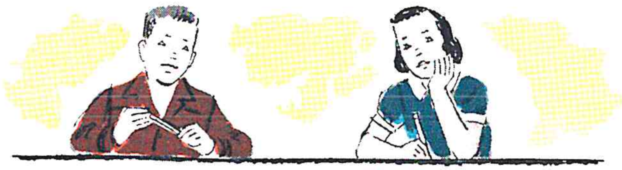
6. Ann has a 2-lb. box of candy and a candy bar that weighs 1 oz. The box is how many times as heavy as the candy bar?

COMPARING BY SUBTRACTION

1. Joe weighs $74\frac{1}{4}$ lb., and Dave weighs $69\frac{3}{4}$ lb. Compare their weights. Label the answer.

2. The temperature yesterday reached 72°. Today it reached 81°. Compare the temperatures.

3. Yesterday Doris practiced her music $1\frac{1}{4}$ hr. Today she practiced $\frac{3}{4}$ hr. Compare the amounts of time.



UNIT 18

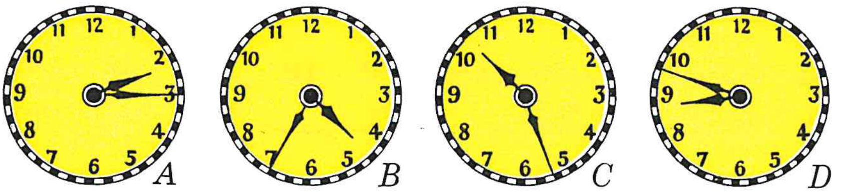
FINDING THE TROUBLE SPOTS

MEANINGS

1. Which number has a 3 in hundreds' place? 72–
   3796 4823 5374 6932 76
2. Write the smallest 3-place whole number.
3. Use digits to write these numbers:
   a. Seventy-five thousand, eighty-six
   b. Four million, eighteen thousand, sixty-two
4. Write these numerals with digits: 70–
   a. VII b. XIV c. XXIX d. XLI 71
5. Without dividing, choose the division in each 84–
row that will have the largest quotient: 86
   a. $31\overline{)847}$ $34\overline{)847}$ $30\overline{)847}$ $32\overline{)847}$
   b. $26\overline{)968}$ $26\overline{)869}$ $26\overline{)698}$ $26\overline{)986}$
6. Without multiplying, choose the multiplication 80–
in each row that will have the largest product: 83
   a. 12×496 12×498 12×500 12×489
   b. 27×365 30×365 29×365 28×365
7. Which fraction in each group is largest? 117–
   a. $\frac{1}{6}$ $\frac{1}{8}$ $\frac{1}{5}$ $\frac{1}{10}$ c. $\frac{2}{4}$ $\frac{3}{5}$ $\frac{4}{8}$ $\frac{3}{6}$ 121
   b. $\frac{2}{8}$ $\frac{7}{8}$ $\frac{3}{8}$ $\frac{5}{8}$ d. $\frac{1}{2}$ $\frac{2}{3}$ $\frac{3}{4}$ $\frac{4}{5}$
8. To check a division, multiply the _?_ by the _?_. 88
9. Write: **a.** a proper fraction; **b.** an improper fraction; **c.** a mixed number. 221

THE MEASURES

1. Tell which measure is likely to be nearest right:
   a. Weight of a loaf of bread: 10 lb. 8 lb. 4 lb. 1 lb.
   b. A glass of milk: $\frac{1}{2}$ pt. $\frac{1}{2}$ qt. 1 qt. $\frac{1}{2}$ gal.
   c. Length of your shoe: 5 in. 9 in. 18 in. 2 ft.
   d. Height of your desk: 12 in. 20 in. 28 in. 36 in.
   e. Height of a door into your classroom:
   5 ft. $6\frac{1}{2}$ ft. $8\frac{1}{2}$ ft. 10 ft.
2. Change the measures below:
   a. 1 yd. 6 in. = ? in.
   b. $1\frac{1}{2}$ hr. = ? min.
   c. 24 oz. = ? lb.
   d. 2 tons = ? lb.
   e. 3 doz. cupcakes = ?
   f. 3 quarters = ? cents
   g. 2 wk. = ? da.
   h. $1\frac{1}{2}$ bu. = ? pk.
3. Write the months that have 30 days.
4. About how many miles do you live from
   a. the nearest ocean? b. from Washington, D. C.?
5. What time will each clock read $\frac{1}{2}$ hr. later?



6. Which will cost more for the same weight?
   a. grain or cereal
   b. potatoes or potato chips
   c. bread or flour
   d. candy or sugar
7. Water begins to freeze nearest:
   0°F. 32°F. $98\frac{3}{5}$°F. 212°F.
8. A very hot day in most of our cities might be:
   50°F. 80°F. 100°F. 150°F.
9. Where you live, the sun might set today nearest:
   7 A.M 1 A.M. 8 P.M. 1 P.M.

ADDITION, SUBTRACTION, MULTIPLICATION

Set 1

4, 6, 12, 15, 16

Add:

1.	2.	3.	4.	5.
$6.87	$67.78	$56.45	$ 6.56	$13.58
3.73	45.46	5.79	17.98	8.67
.46	5.37	54.88	9.89	46.92
.02	83.50	34.07	66.77	8.09

Set 2

8, 17–19

Subtract:

1.	2.	3.	4.	5.
431	102	5717	920	1181
392	38	4890	550	504

6.	7.	8.	9.	10.
6357	9841	1466	1563	1398
5789	3898	697	575	429

11.	12.	13.	14.	15.
3034	1314	1200	6590	4603
2670	374	305	5939	3670

16.	17.	18.	19.	20.
1604	2406	110	1350	1710
836	1466	27	804	983

Set 3

40–41

Multiply:

1.	2.	3.	4.	5.
853	860	509	905	790
70	49	58	60	30

6.	7.	8.	9.	10.
964	963	846	794	497
47	97	38	69	85

11.	12.	13.	14.	15.
457	368	358	375	873
79	68	39	84	57

FRACTIONS

Set 1 219

Change the terms of the fractions below:

1. $\frac{1}{2}$ to $\frac{?}{8}$	**5.** $\frac{2}{4}$ to $\frac{?}{2}$	**9.** $\frac{12}{16}$ to $\frac{?}{4}$	**13.** $\frac{2}{3}$ to $\frac{?}{6}$
2. $\frac{1}{4}$ to $\frac{?}{12}$	**6.** $\frac{3}{12}$ to $\frac{?}{4}$	**10.** $\frac{6}{8}$ to $\frac{?}{4}$	**14.** $\frac{3}{5}$ to $\frac{?}{10}$
3. $\frac{1}{3}$ to $\frac{?}{9}$	**7.** $\frac{2}{10}$ to $\frac{?}{5}$	**11.** $\frac{8}{10}$ to $\frac{?}{5}$	**15.** $\frac{3}{4}$ to $\frac{?}{8}$
4. $\frac{1}{5}$ to $\frac{?}{10}$	**8.** $\frac{2}{6}$ to $\frac{?}{3}$	**12.** $\frac{8}{12}$ to $\frac{?}{3}$	**16.** $\frac{5}{6}$ to $\frac{?}{12}$

17. Change these fractions to mixed numbers: 220–221

a. $\frac{5}{4}$ **b.** $\frac{3}{2}$ **c.** $\frac{8}{3}$ **d.** $\frac{12}{5}$ **e.** $\frac{16}{8}$ **f.** $\frac{15}{6}$

18. Change to mixed numbers, but do not reduce terms:

a. $\frac{6}{4}$ **b.** $\frac{9}{2}$ **c.** $\frac{12}{8}$ **d.** $\frac{10}{4}$ **e.** $\frac{15}{12}$ **f.** $\frac{16}{3}$

Set 2

Add and change sums to lowest terms:

1. $\begin{array}{r}\frac{1}{3}\\ \underline{\frac{1}{3}}\end{array}$	**2.** $\begin{array}{r}1\\ \underline{\frac{3}{4}}\end{array}$	**3.** $\begin{array}{r}2\\ \underline{2\frac{1}{3}}\end{array}$	**4.** $\begin{array}{r}2\frac{2}{5}\\ \underline{\frac{1}{5}}\end{array}$	**5.** $\begin{array}{r}1\frac{1}{8}\\ \underline{\frac{3}{8}}\end{array}$	**6.** $\begin{array}{r}\frac{1}{2}\\ \underline{2\frac{1}{6}}\end{array}$	124–136
7. $\begin{array}{r}\frac{1}{2}\\ \underline{\frac{1}{2}}\end{array}$	**8.** $\begin{array}{r}\frac{2}{5}\\ \underline{\frac{3}{5}}\end{array}$	**9.** $\begin{array}{r}\frac{2}{3}\\ \underline{\frac{2}{3}}\end{array}$	**10.** $\begin{array}{r}\frac{5}{6}\\ \underline{\frac{3}{6}}\end{array}$	**11.** $\begin{array}{r}\frac{3}{4}\\ \underline{\frac{3}{8}}\end{array}$	**12.** $\begin{array}{r}\frac{2}{3}\\ \underline{\frac{5}{6}}\end{array}$	223
13. $\begin{array}{r}\frac{1}{4}\\ \underline{1\frac{3}{4}}\end{array}$	**14.** $\begin{array}{r}2\frac{4}{5}\\ \underline{\frac{3}{5}}\end{array}$	**15.** $\begin{array}{r}3\frac{5}{8}\\ \underline{1\frac{1}{2}}\end{array}$	**16.** $\begin{array}{r}1\frac{3}{5}\\ \underline{2\frac{7}{10}}\end{array}$	**17.** $\begin{array}{r}4\frac{5}{6}\\ \underline{2\frac{2}{3}}\end{array}$	**18.** $\begin{array}{r}2\frac{3}{4}\\ \underline{1\frac{7}{8}}\end{array}$	224–225

Set 3

Subtract and change remainders to lowest terms:

1. $\begin{array}{r}\frac{2}{3}\\ \underline{\frac{1}{3}}\end{array}$	**2.** $\begin{array}{r}\frac{3}{4}\\ \underline{\frac{1}{4}}\end{array}$	**3.** $\begin{array}{r}\frac{5}{6}\\ \underline{\frac{3}{6}}\end{array}$	**4.** $\begin{array}{r}\frac{7}{10}\\ \underline{\frac{2}{10}}\end{array}$	**5.** $\begin{array}{r}\frac{3}{4}\\ \underline{\frac{1}{2}}\end{array}$	**6.** $\begin{array}{r}\frac{5}{6}\\ \underline{\frac{1}{3}}\end{array}$	125–127
7. $\begin{array}{r}1\frac{3}{5}\\ \underline{\frac{1}{5}}\end{array}$	**8.** $\begin{array}{r}4\frac{1}{2}\\ \underline{4}\end{array}$	**9.** $\begin{array}{r}3\frac{1}{3}\\ \underline{\frac{1}{3}}\end{array}$	**10.** $\begin{array}{r}1\frac{3}{4}\\ \underline{1}\end{array}$	**11.** $\begin{array}{r}2\frac{1}{2}\\ \underline{\frac{1}{4}}\end{array}$	**12.** $\begin{array}{r}2\frac{5}{6}\\ \underline{\frac{1}{3}}\end{array}$	140–141

FRACTIONS (continued)

Subtract and change remainders to lowest terms:

1. 1	**2.** 2	**3.** 5	**4.** 3	**5.** 4	**6.** 2	226–
$\underline{\frac{1}{3}}$	$\underline{\frac{3}{4}}$	$\underline{2\frac{1}{2}}$	$\underline{1\frac{2}{5}}$	$\underline{3\frac{5}{6}}$	$\underline{1\frac{1}{4}}$	228
7. $2\frac{1}{4}$	**8.** $1\frac{1}{3}$	**9.** $1\frac{1}{4}$	**10.** $3\frac{2}{5}$	**11.** $4\frac{3}{8}$	**12.** $3\frac{1}{6}$	230–
$\underline{\frac{3}{4}}$	$\underline{\frac{2}{3}}$	$\underline{\frac{3}{4}}$	$\underline{1\frac{4}{5}}$	$\underline{1\frac{5}{8}}$	$\underline{1\frac{5}{6}}$	231

THE ANSWER STRIP

Use an answer strip.

Make two columns. Write the answers as you did for page 255.

Your teacher will read the divisions.

(1)	(7)	(13)	(19)
3's in 22	6's in 43	7's in 45	9's in 79
5's in 42	9's in 68	3's in 29	7's in 60
9's in 38	7's in 55	8's in 75	3's in 26
7's in 39	5's in 38	6's in 53	6's in 59
4's in 27	8's in 43	9's in 59	5's in 49
8's in 53	4's in 33	4's in 31	8's in 63

DIVISION OF WHOLE NUMBERS

Set 1 45–48

	a	b	c	d	e
1.	$6\overline{)444}$	$8\overline{)360}$	$4\overline{)1224}$	$9\overline{)459}$	$7\overline{)1610}$
2.	$8\overline{)549}$	$6\overline{)511}$	$7\overline{)664}$	$5\overline{)398}$	$9\overline{)674}$
3.	$3\overline{)2128}$	$7\overline{)4907}$	$9\overline{)7744}$	$6\overline{)3545}$	$8\overline{)5603}$

Set 2 248, 252

If a division has been started correctly, write *yes*. If not, write *no*. Use mental multiplication. Then check by dividing.

	a	b	c	d	e
1.	$\begin{array}{r}7\\74\overline{)529}\end{array}$	$\begin{array}{r}9\\56\overline{)485}\end{array}$	$\begin{array}{r}9\\45\overline{)390}\end{array}$	$\begin{array}{r}7\\63\overline{)482}\end{array}$	$\begin{array}{r}5\\18\overline{)96}\end{array}$
2.	$\begin{array}{r}3\\22\overline{)594}\end{array}$	$\begin{array}{r}3\\34\overline{)952}\end{array}$	$\begin{array}{r}2\\45\overline{)855}\end{array}$	$\begin{array}{r}2\\38\overline{)988}\end{array}$	$\begin{array}{r}3\\29\overline{)812}\end{array}$

Set 3 248–258

Divide and check:

1. $25\overline{)325}$	**2.** $35\overline{)805}$	**3.** $84\overline{)6384}$	**4.** $26\overline{)598}$
5. $39\overline{)468}$	**6.** $58\overline{)3248}$	**7.** $48\overline{)1632}$	**8.** $94\overline{)7426}$
9. $72\overline{)4176}$	**10.** $36\overline{)1548}$	**11.** $69\overline{)3726}$	**12.** $37\overline{)1258}$
13. $68\overline{)5100}$	**14.** $92\overline{)7912}$	**15.** $57\overline{)4218}$	**16.** $87\overline{)6003}$
17. $74\overline{)4292}$	**18.** $96\overline{)8256}$	**19.** $79\overline{)5767}$	**20.** $86\overline{)8084}$

Set 4

Divide and check:

1. $26\overline{)780}$	**2.** $37\overline{)11840}$	**3.** $72\overline{)33120}$	**4.** $63\overline{)44100}$
5. $84\overline{)42756}$	**6.** $92\overline{)73552}$	**7.** $86\overline{)34400}$	**8.** $52\overline{)36690}$
9. $48\overline{)4656}$	**10.** $69\overline{)5451}$	**11.** $57\overline{)5586}$	**12.** $47\overline{)3196}$
13. $59\overline{)5097}$	**14.** $38\overline{)15521}$	**15.** $57\overline{)4251}$	**16.** $93\overline{)5512}$
17. $49\overline{)2337}$	**18.** $59\overline{)37771}$	**19.** $86\overline{)43263}$	**20.** $78\overline{)52899}$

UNDERSTANDING PROBLEMS

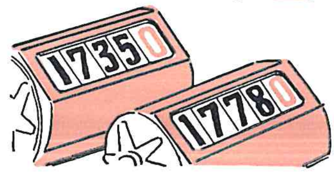
Write what you would do to find the answer if you had a problem like each one below. You may need to draw a picture or make up numbers to help you.

1. If you know how much several boys weigh, how do you find the average weight?

2. If you know the cost of a dozen balls, how do you find the cost of one ball?

3. You know how much a baseball suit costs. You have some money, but not enough. How do you find out how much more money is needed?

4. You know how much money one gallon of gasoline costs. How do you tell how much 10 gallons will cost?



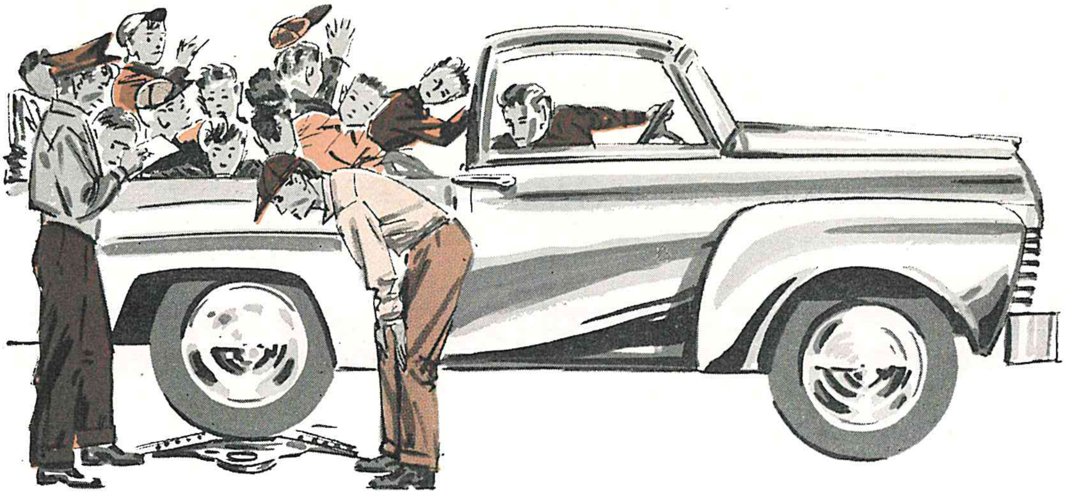
5. You read the miles on your cyclometer on Monday. You read them again on Saturday. How do you find out how far the bicycle has gone during the week?

6. You know what it costs for each parent and for each child to go to a show. How do you find out what it costs for 2 parents and 3 children to go?

7. You know how many people will come to a party. You know how many servings you can get from a quart of ice cream. How do you tell how many gallons to buy?

8. You know how many feet and inches long a board is. How can you tell where to saw it to make two equal pieces?

9. You know how far you have gone. You know how much farther you must go. How do you tell how far the distance was at the beginning?



SOLVING PROBLEMS

1. Mr. Wilson took 15 boys in a truck to a picnic. All of them were weighed on a big scale. The total weight of the boys was 1080 lb. What was the average weight?

2. How much will each pencil cost? The price of a dozen pencils is 72¢.

3. How much more money will Bob need to buy a new bicycle tire? He has $1.75. The tire costs $2.49.

4. How much money did Peg's mother pay for 10 phonograph records at a sale? The records sold for 49¢ each.

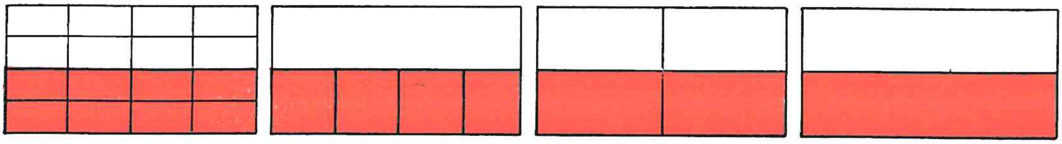
5. The miles on Mr. Parker's car read 6487 at the beginning of a trip. How far had he gone on the trip when the miles shown were 6772?

6. Mr. and Mrs. Camp and three children are planning a train ride. The children have never ridden on a train. The fare for grownups is $1.40 each. Each child rides for a half fare, which is 70¢. What will all five tickets cost?

7. How many gallons of punch will be needed for a party for 40 children? Each quart will serve 5 children.

8. How far from the end will be the middle of a board which is 6 ft. 8 in. long?

UNRELATED DENOMINATORS



UNLIKE DENOMINATORS

1. The rectangles above are nearly equal in size. What part is colored in each?

2. Are $\frac{8}{16}$, $\frac{4}{8}$, $\frac{2}{4}$, and $\frac{1}{2}$ of the same thing equal in size?

3. Are the denominators in Ex. 2 alike or unlike?

4. Can 16 be divided evenly by 8? by 4? by 2?

• When one denominator can be divided evenly by another, the denominators are said to be **related.**

• When denominators are the same numbers, they are called **like** denominators. If the numbers are different, the denominators are **unlike.**

5. Which pairs of denominators are *alike* in **a** to **l**?

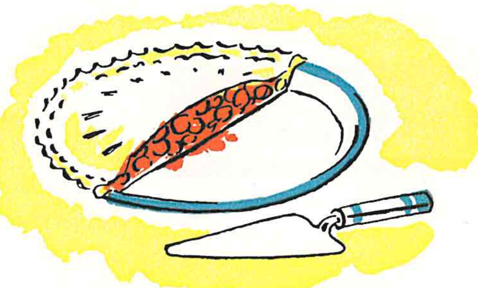
a. $\frac{1}{4} + \frac{1}{2}$	**e.** $\frac{1}{4} + \frac{1}{8}$	**i.** $\frac{1}{5} + \frac{1}{10}$
b. $\frac{1}{5} + \frac{2}{5}$	**f.** $\frac{1}{8} + \frac{3}{8}$	**j.** $\frac{2}{3} + \frac{2}{5}$
c. $\frac{1}{6} + \frac{1}{2}$	**g.** $\frac{1}{4} + \frac{1}{5}$	**k.** $\frac{1}{2} + \frac{1}{5}$
d. $\frac{1}{2} + \frac{1}{3}$	**h.** $\frac{1}{3} + \frac{1}{4}$	**l.** $\frac{1}{12} + \frac{3}{12}$

6. Which pairs are *unlike*, but *related*?

Change one fraction of each pair so that the denominators will be alike:

7. $\frac{1}{3}$ and $\frac{1}{6}$	**11.** $\frac{1}{2}$ and $\frac{1}{6}$	**15.** $\frac{3}{8}$ and $\frac{3}{16}$	**19.** $\frac{1}{16}$ and $\frac{3}{4}$
8. $\frac{1}{2}$ and $\frac{1}{8}$	**12.** $\frac{5}{12}$ and $\frac{1}{6}$	**16.** $\frac{3}{12}$ and $\frac{1}{4}$	**20.** $\frac{1}{4}$ and $\frac{5}{8}$
9. $\frac{1}{6}$ and $\frac{1}{2}$	**13.** $\frac{2}{3}$ and $\frac{1}{12}$	**17.** $\frac{1}{2}$ and $\frac{5}{12}$	**21.** $\frac{3}{10}$ and $\frac{2}{5}$
10. $\frac{1}{5}$ and $\frac{1}{10}$	**14.** $\frac{1}{4}$ and $\frac{1}{2}$	**18.** $\frac{3}{10}$ and $\frac{1}{2}$	**22.** $\frac{1}{2}$ and $\frac{5}{16}$

UNRELATED FRACTIONS

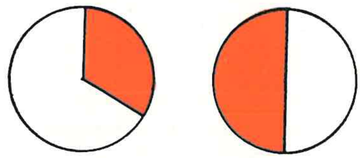


1. Can you change $\frac{1}{2}$ of a pie to 4ths with none left over?

2. Can you change $\frac{1}{4}$ of a pie to 8ths with none left over?

3. Are the denominators of halves and fourths alike or unlike? Are the denominators of fourths and eighths alike?

● Halves and fourths are **unlike,** but they are **related.** Fourths and eighths also are unlike, but related.



4. Divide a circle or piece of paper into halves. Divide another piece of the same size into thirds. Lay the third on the half. Is some of the half left over?

5. Compare the third and the half. How much bigger is the half? Is it hard to tell?

● To compare halves and thirds more accurately, you need to change them to sixths. Halves and thirds are **unrelated fractions.** You change both to a different fraction to compare them, and also to add them.

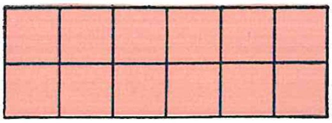
6. Change $\frac{1}{2}$ to sixths. Change $\frac{1}{3}$ to sixths. Compare them. Which is larger? How much larger?

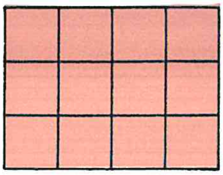
7. Change $\frac{1}{3}$ and $\frac{1}{4}$ to twelfths and compare them.

8. Change $\frac{1}{2}$ and $\frac{1}{5}$ to tenths and compare them.

9. Change each pair of fractions below to like denominators and compare them.

a. $\frac{1}{2}$ and $\frac{2}{3}$	**b.** $\frac{1}{4}$ and $\frac{1}{3}$	**c.** $\frac{3}{5}$ and $\frac{1}{2}$
d. $\frac{2}{5}$ and $\frac{1}{2}$	**e.** $\frac{3}{4}$ and $\frac{2}{3}$	**f.** $\frac{1}{2}$ and $\frac{1}{3}$





SEEING ADDITION OF UNLIKE FRACTIONS

1. Make a card with a dozen squares. Make it 2 squares wide and 6 squares long.

2. Make another card 3 squares wide and 4 squares long. Is each square $\frac{1}{12}$ of a dozen?

3. Make 12 squares of colored paper the same size as the squares you marked on your cards. Place them on the cards as asked for below:

a. Place the pieces on $\frac{1}{3}$ dozen and $\frac{1}{2}$ dozen of the same card. How much of the card is covered? Is it $\frac{10}{12}$ dozen? Is that $\frac{5}{6}$?

b. How many twelfths are covered when you place colored squares on $\frac{1}{4}$ and $\frac{1}{2}$? on $\frac{1}{6}$ and $\frac{1}{3}$? on $\frac{1}{4}$ and $\frac{1}{6}$? on $\frac{2}{3}$ and $\frac{1}{4}$? on $\frac{1}{2}$ and $\frac{1}{3}$? on $\frac{1}{6}$ and $\frac{3}{4}$?

c. If you cover $\frac{2}{3}$ of a dozen, how much of the dozen is not yet covered? Will $\frac{1}{4}$ dozen cover what is left? Is $\frac{2}{3}$ dozen + $\frac{1}{4}$ dozen equal to, less than, or more than 1 dozen?

4. Reason out the additions below. Which sums will be less than 1? equal to 1? greater than 1?

a. $\frac{1}{2} + \frac{1}{3}$ **c.** $\frac{1}{3} + \frac{5}{6}$ **e.** $\frac{5}{6} + \frac{1}{4}$ **g.** $\frac{2}{3} + \frac{1}{2}$
b. $\frac{1}{4} + \frac{2}{3}$ **d.** $\frac{3}{4} + \frac{1}{3}$ **f.** $\frac{1}{2} + \frac{1}{6}$ **h.** $\frac{3}{4} + \frac{1}{2}$

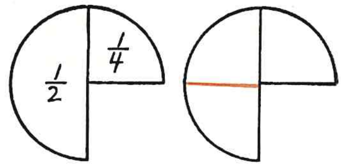
5. Check your answers for Number 4 above by using your squares and cards of a dozen.

How can you tell if each sum is more or less than 1?

a. $\frac{3}{4} + \frac{1}{5}$ **b.** $\frac{1}{2} + \frac{2}{5}$ **c.** $\frac{2}{3} + \frac{3}{5}$

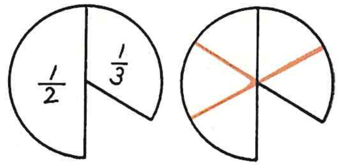
ADDING UNRELATED FRACTIONS

1. You can put $\frac{1}{2}$ and $\frac{1}{4}$ together this way: →



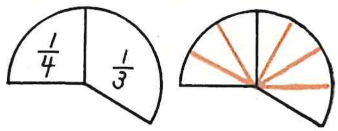
You can add $\frac{1}{2}$ and $\frac{1}{4}$, but what can you call the sum? Change the $\frac{1}{2}$ to $\frac{2}{4}$.

2. How much is $\frac{1}{2} + \frac{1}{3}$?



To find like denominators for $\frac{1}{2}$ and $\frac{1}{3}$, multiply the larger denominator by 2. $2 \times 3 = 6$. Can you change $\frac{1}{2}$ to $\frac{?}{6}$? Can you multiply 2 by any number to make 6? You can, because 6 divides evenly by 2.

3. What will the sum be for $\frac{1}{4} + \frac{1}{3}$? First multiply the larger denominator by 2. $2 \times 4 = 8$. Can you multiply the smaller denominator (3) by any whole number to make 8? No, because $8 \div 3 = 2\frac{2}{3}$. Next, try multiplying the larger denominator by 3. $3 \times 4 = 12$. Can the smaller denominator (3) be multiplied by any whole number to make 12? Can 12 be divided evenly by 3? Yes, so 12 can be used as the denominator of both fractions.



$$\begin{array}{rcl} \frac{1}{4} & = & \frac{3}{12} \\ \frac{1}{3} & = & \frac{4}{12} \\ \hline & & \frac{7}{12} \end{array}$$

● To find the smallest like denominator, multiply the largest denominator by 2. If the product cannot be divided evenly by the other denominator, multiply by 3, then by 4, and so on until you find a number that can be divided evenly by the other denominator.

4. Change to like denominators and add:

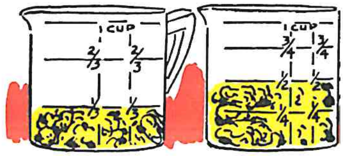
a. $\frac{1}{4} + \frac{2}{3}$ **b.** $\frac{1}{2} + \frac{1}{5}$ **c.** $\frac{1}{2} + \frac{1}{3}$ **d.** $\frac{1}{3} + \frac{1}{5}$ **e.** $\frac{1}{4} + \frac{1}{5}$

f. $\frac{2}{3} + \frac{5}{6}$ **g.** $\frac{2}{5} + \frac{1}{3}$ **h.** $\frac{3}{4} + \frac{3}{8}$ **i.** $\frac{2}{3} + \frac{1}{2}$ **j.** $\frac{1}{4} + \frac{1}{6}$

SUBTRACTING UNRELATED FRACTIONS

1. Dot and Sally are making fudge. How many more nut meats do they need? The recipe calls for $\frac{1}{2}$ cup. They now have $\frac{1}{3}$ cup.

a. Look at the cups at the right. Estimate how much more they will need. Will it be another third? another fourth?



b. Dot and Sally subtract $\frac{1}{3}$ cup from $\frac{1}{2}$ cup to find out. They first change the fractions to like denominators.

$$\begin{array}{rcr} \frac{1}{2} & = & \frac{3}{6} \\ -\frac{1}{3} & = & \frac{2}{6} \\ \hline & & \frac{1}{6} \end{array}$$

What part of a cup do they still need?

2. The recipe calls for $1\frac{1}{2}$ cups of sugar. Dot's mother says she has $\frac{2}{3}$ cup of brown sugar. If the rest is white sugar, how much of it will they need?

Dot first changes halves and thirds to the same denominator. Why does she change $1\frac{3}{6}$ to $\frac{9}{6}$?

$$\begin{array}{rcrcr} 1\frac{1}{2} & = & 1\frac{3}{6} & = & \frac{9}{6} \\ -\ \frac{2}{3} & = & \frac{4}{6} & = & \frac{4}{6} \\ \hline & & & & \frac{5}{6} \end{array}$$

● When fractions are changed to the same denominator to add or subtract, the new denominator is often called the **common** denominator. It is easier to understand and remember **like** denominators.

3. Do these subtractions. To find the like denominator to use, first multiply the largest denominator by 2, then by 3, and so on as you did on page 271.

a. $\frac{2}{3} - \frac{1}{2}$

b. $\frac{4}{5} - \frac{1}{2}$

c. $\frac{2}{3} - \frac{1}{4}$

d. $1\frac{1}{2} - \frac{2}{5}$

e. $\frac{3}{4} - \frac{1}{3}$

f. $\frac{1}{2} - \frac{1}{5}$

g. $\begin{array}{r} 2\frac{1}{2} \\ \underline{\frac{2}{3}} \end{array}$

h. $\begin{array}{r} 1\frac{1}{2} \\ \underline{\frac{4}{5}} \end{array}$

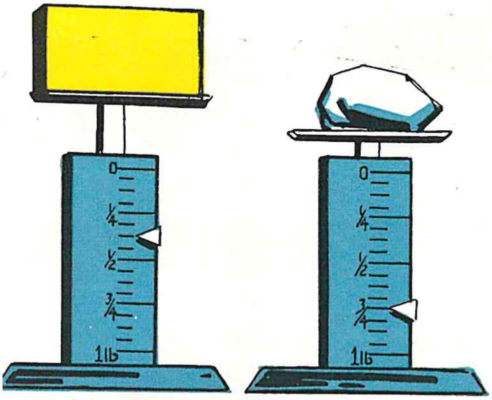
i. $\begin{array}{r} 1\frac{1}{3} \\ \underline{\frac{3}{4}} \end{array}$

j. $\begin{array}{r} 1\frac{2}{5} \\ \underline{\frac{1}{2}} \end{array}$

k. $\begin{array}{r} 1\frac{1}{4} \\ \underline{\frac{2}{3}} \end{array}$

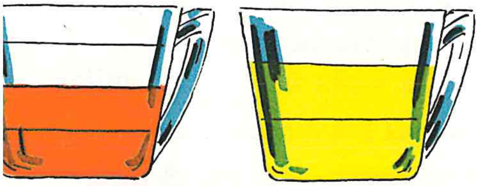
l. $\begin{array}{r} 1\frac{1}{3} \\ \underline{\frac{1}{2}} \end{array}$

FRACTIONS OF MEASURES



1. Joe is sending a rock from his collection to a friend. He first weighs the box and then the rock.

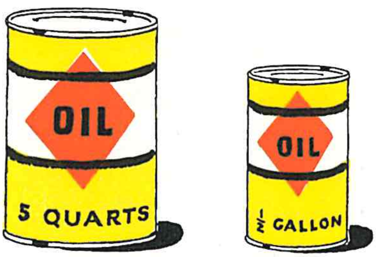
How much do both weigh in ounces? in pounds?



Orange juice

Lemonade

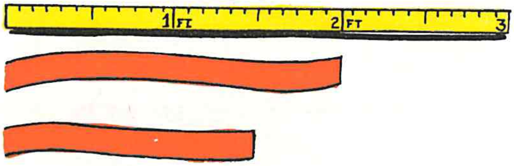
2. How many cups all together?



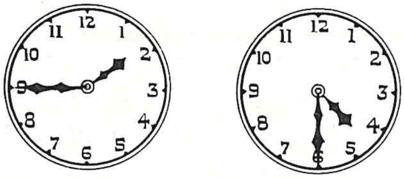
5 qt. oil

$\frac{1}{2}$ gal. oil

3. How many gallons in all?



4. This yardstick shows how many yards in each ribbon. How many yards all together?



A

B

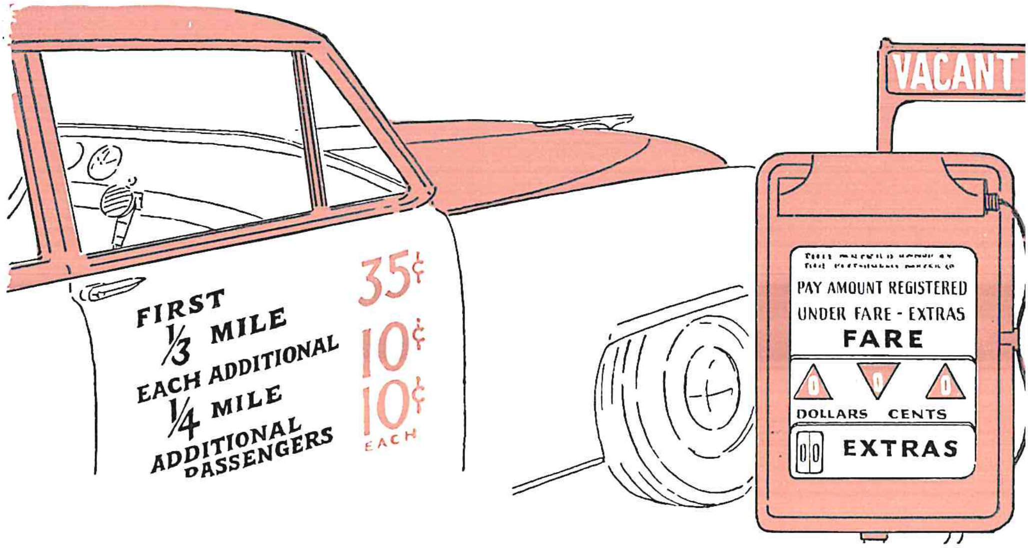
5. How many hours is it from time *A* to time *B*?

6. How much above $98\frac{3}{5}$ degrees does the thermometer show?

Halves

Quarters

7. What is the difference in dollars in the two piles?



PROBLEMS WITH FRACTIONS

Gary read the above sign on the door of a taxicab. Use the information he read to answer the problems below.

When the taxicab starts, the driver sets the meter at 35¢. So any distance up to $\frac{1}{3}$ mile costs 35¢. At $\frac{1}{3}$ mile, the meter turns up $\boxed{\;\;}\boxed{4}\boxed{5}$, which is 10¢ more for the next $\frac{1}{4}$ mile, and so on.

1. If any distance less than $\frac{1}{3}$ mile is 35¢, would the first $\frac{1}{4}$ mile be 35¢?

2. How much is the taxi fare for $\frac{1}{2}$ mile? Will 35¢ and 10¢ be enough?

3. What will be the fare for 1 mile? 2 miles?

4. What is the difference between the cost of the first mile and the cost of the second mile?

5. What will it cost for 2 people to ride $\frac{3}{4}$ mile?

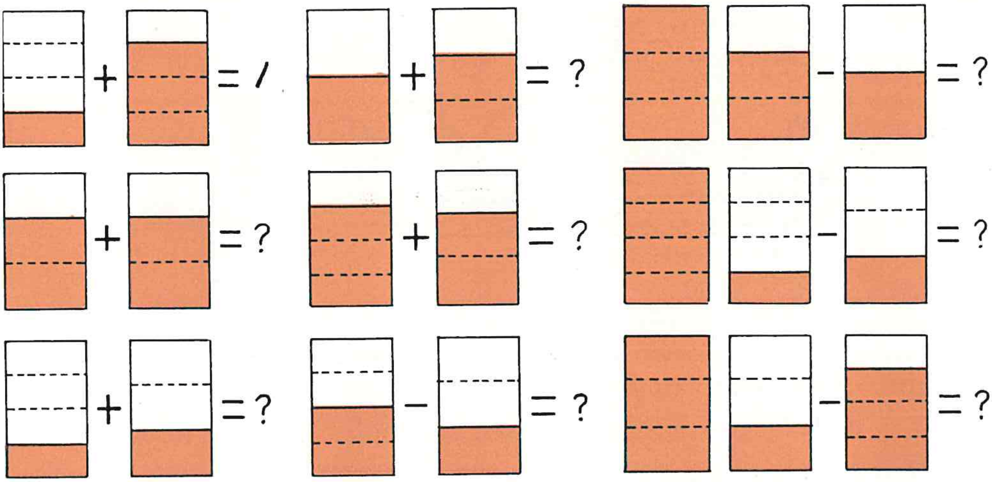
6. What is the fare for 4 people for $1\frac{1}{2}$ mile?

7. How much more does it cost for 4 people to go a mile in a taxicab than to go by bus at 15¢ each?

PRACTICE

Set 1

Add or subtract as the sign tells you. The first one is done for you.



Set 2

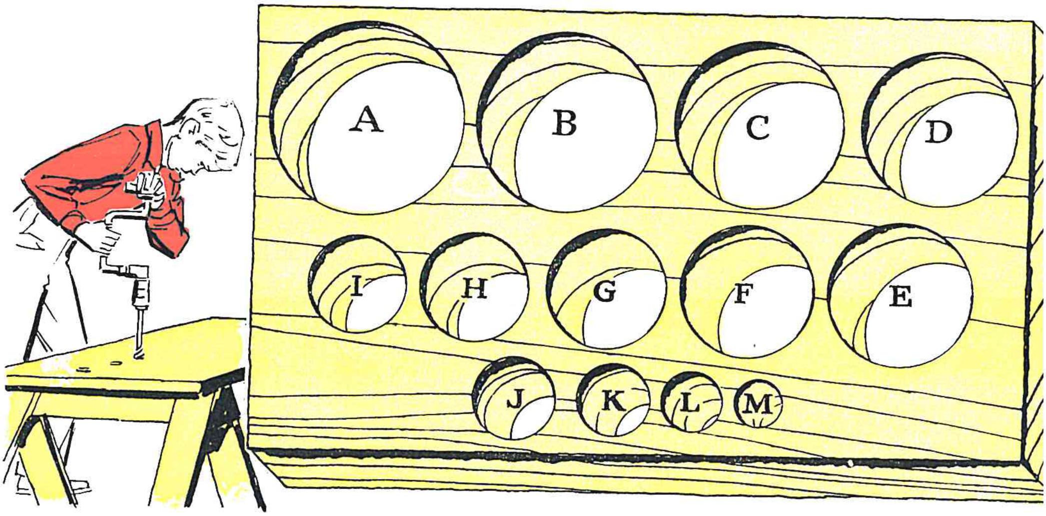
Find the like denominator for each pair of fractions. Then add each pair.

1. $\frac{1}{2}$ and $\frac{1}{4}$	**4.** $\frac{1}{5}$ and $\frac{1}{2}$	**7.** $\frac{2}{5}$ and $\frac{3}{10}$	**10.** $\frac{3}{4}$ and $\frac{1}{6}$
2. $\frac{1}{3}$ and $\frac{1}{2}$	**5.** $\frac{1}{8}$ and $\frac{1}{4}$	**8.** $\frac{1}{2}$ and $\frac{1}{6}$	**11.** $\frac{1}{2}$ and $\frac{1}{10}$
3. $\frac{1}{4}$ and $\frac{2}{3}$	**6.** $\frac{2}{3}$ and $\frac{1}{6}$	**9.** $\frac{3}{8}$ and $\frac{1}{2}$	**12.** $\frac{5}{12}$ and $\frac{1}{4}$

Set 3

Subtract. Change answers to lowest terms.

1. $\begin{array}{r}\frac{3}{4}\\ \underline{\frac{1}{2}}\end{array}$	**2.** $\begin{array}{r}\frac{1}{2}\\ \underline{\frac{1}{3}}\end{array}$	**3.** $\begin{array}{r}\frac{3}{4}\\ \underline{\frac{2}{3}}\end{array}$	**4.** $\begin{array}{r}\frac{7}{8}\\ \underline{\frac{3}{4}}\end{array}$	**5.** $\begin{array}{r}\frac{5}{6}\\ \underline{\frac{1}{3}}\end{array}$
6. $\begin{array}{r}2\frac{9}{10}\\ \underline{1\frac{1}{2}}\end{array}$	**7.** $\begin{array}{r}2\frac{4}{5}\\ \underline{2\frac{1}{2}}\end{array}$	**8.** $\begin{array}{r}2\frac{3}{4}\\ \underline{1\frac{3}{8}}\end{array}$	**9.** $\begin{array}{r}2\frac{1}{5}\\ \underline{2\frac{1}{10}}\end{array}$	**10.** $\begin{array}{r}2\frac{1}{3}\\ \underline{2\frac{1}{4}}\end{array}$
11. $\begin{array}{r}1\frac{3}{8}\\ \underline{\frac{3}{4}}\end{array}$	**12.** $\begin{array}{r}1\frac{1}{2}\\ \underline{\frac{5}{6}}\end{array}$	**13.** $\begin{array}{r}2\frac{1}{4}\\ \underline{\frac{2}{3}}\end{array}$	**14.** $\begin{array}{r}3\frac{1}{2}\\ \underline{2\frac{2}{3}}\end{array}$	**15.** $\begin{array}{r}2\frac{3}{10}\\ \underline{\frac{3}{5}}\end{array}$



JACK'S NEW WOOD BITS

These are holes that Jack can bore with his new wood bits. Hole A is 1 inch across. E is $\frac{3}{4}$ inch across. Each hole is $\frac{1}{16}$ inch larger or smaller than the holes next to it. Hole M is $\frac{1}{4}$ inch across.

1. How large (far across) is hole K? G? C?

2. How large is circle B? E? J?

3. How large is circle D? H? A?

4. Read the sizes of the circles from M through A.

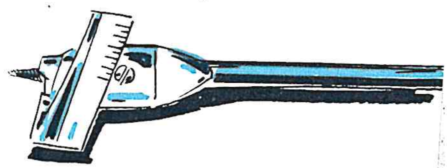
5. See how quickly you can locate the circles of these sizes. $\frac{7''}{8}$ $\frac{3''}{8}$ $\frac{5''}{8}$ $\frac{7''}{16}$ $\frac{11''}{16}$

6. Estimate these sizes and then measure them. →

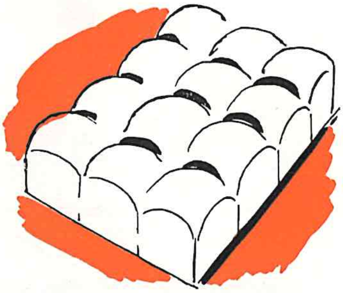
● The distance across a circle through its center is called its **diameter.**

7. What size bit has a diameter halfway between $\frac{1''}{2}$ and $\frac{5''}{8}$? $\frac{3''}{8}$ and $\frac{5''}{8}$? $\frac{1''}{4}$ and $\frac{3''}{8}$?

Do you know what an expansive bit is?



FINDING THE SMALLEST LIKE DENOMINATOR



1. Mrs. Hart bought a dozen buns. "We'll use a half dozen for supper," she said, "and a third of a dozen for lunch tomorrow." What fraction will have been used after lunch time tomorrow?

Joyce adds: $\frac{1}{2} = \frac{6}{12}$, $\frac{1}{3} = \frac{4}{12}$, $\frac{10}{12}$

Lee adds: $\frac{1}{2} = \frac{3}{6}$, $\frac{1}{3} = \frac{2}{6}$, $\frac{5}{6}$

2. Do Joyce and Lee get equal answers?

3. Which used the smaller number for the like denominators?

Use these two steps to find the smallest like denominators:

First Step: Try one of the denominators.

In which three of these additions can one of the denominators be used for like denominators? How can you tell?

a. $\frac{1}{2} + \frac{1}{4}$ **b.** $\frac{1}{3} + \frac{1}{6}$ **c.** $\frac{1}{3} + \frac{1}{4}$ **d.** $\frac{1}{5} + \frac{1}{10}$ **e.** $\frac{1}{2} + \frac{1}{5}$

Second Step: If one of the denominators cannot be used, multiply the largest denominator by 2, 3, 4, and so on until you find one that can be used. Try the step with these fractions:

a. $\frac{1}{3} + \frac{1}{2}$ **b.** $\frac{1}{4} + \frac{1}{3}$ **c.** $\frac{1}{2} + \frac{2}{5}$ **d.** $\frac{1}{3} + \frac{1}{10}$ **e.** $\frac{1}{4} + \frac{1}{6}$

4. What is the difference:

a. between $\frac{1}{3}$ and $\frac{1}{4}$ share of a dozen cupcakes?

b. between $\frac{1}{3}$ and $\frac{1}{2}$ share of a package of raisins?

c. between $\frac{1}{2}$ and $\frac{1}{4}$ share of an orange?

d. between $\frac{1}{4}$ and $\frac{1}{5}$ share of a pitcher of punch?

ADDING THREE FRACTIONS

1. Two girls were starting to make 24 May baskets. "We'll make half of them this afternoon," said Kathy. "I'll make a fourth tonight, and you can make a fourth of them at home." Will that be 24 May baskets?

HELEN THOUGHT:

$$\begin{aligned}\tfrac{1}{2} \text{ of } 24 &= 12\\ \tfrac{1}{4} \text{ of } 24 &= 6\\ \tfrac{1}{4} \text{ of } 24 &= \underline{6}\\ &\ 24\end{aligned}$$

KATHY THOUGHT:

$$\begin{aligned}\tfrac{1}{2} &= \tfrac{2}{4}\\ \tfrac{1}{4} &= \tfrac{1}{4}\\ \underline{\tfrac{1}{4}} &= \underline{\tfrac{1}{4}}\\ \text{All of them} &\ \tfrac{4}{4}\end{aligned}$$

2. If you add $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{1}{8}$, can one of their denominators be used to make like denominators? Which one?

3. What denominator would you change these fractions to if you wanted to add them?

a. $\frac{1}{4} + \frac{1}{2} + \frac{3}{4}$ **b.** $\frac{1}{5} + \frac{1}{2} + \frac{1}{10}$ **c.** $\frac{1}{2} + \frac{1}{3} + \frac{1}{4}$

In which did you multiply by 2, then 3, and so on?

4. Explain Example **a.** Then add **b–g.**

a.

$$\begin{aligned}\tfrac{1}{2} &= \tfrac{6}{12}\\ \tfrac{1}{3} &= \tfrac{4}{12}\\ \underline{\tfrac{1}{4}} &= \underline{\tfrac{3}{12}}\\ &\ \tfrac{13}{12} = 1\tfrac{1}{12}\end{aligned}$$

b	c	d	e	f	g
$\frac{1}{2}$	$\frac{1}{8}$	$\frac{1}{6}$	$\frac{3}{4}$	$\frac{1}{10}$	$\frac{1}{12}$
$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{8}$	$\frac{2}{5}$	$\frac{3}{4}$
$\frac{3}{4}$	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{2}{3}$

UNIT TEST

Set 1. Understanding Denominators

1. Which pairs of fractions have *like* denominators?

a. $\frac{1}{2} + \frac{1}{4}$ **b.** $\frac{1}{8} + \frac{3}{8}$ **c.** $\frac{1}{5} + \frac{3}{5}$ **d.** $\frac{2}{3} + \frac{1}{2}$ **e.** $\frac{1}{2} + \frac{2}{5}$

f. $\frac{1}{4} + \frac{5}{8}$ **g.** $\frac{1}{2} + \frac{7}{8}$ **h.** $\frac{1}{4} + \frac{1}{3}$ **i.** $\frac{1}{2} + \frac{3}{10}$ **j.** $\frac{1}{3} + \frac{1}{6}$

2. In which pairs of fractions above are the denominators *unlike*?

3. In which of these pairs can you use one of the denominators as the *common* (like) denominator?

a. $\frac{1}{6} + \frac{1}{3}$ **b.** $\frac{1}{5} + \frac{1}{2}$ **c.** $\frac{1}{4} + \frac{1}{8}$ **d.** $\frac{1}{4} + \frac{1}{3}$ **e.** $\frac{1}{5} + \frac{1}{10}$

4. In which of the 5 pairs above do you multiply the largest denominator by 2, then by 3, and so on?

5. Find the numerators for these fractions:

a. $\frac{1}{3} = \frac{?}{12}$ **b.** $\frac{1}{5} = \frac{?}{10}$ **c.** $\frac{4}{12} = \frac{?}{3}$ **d.** $\frac{6}{16} = \frac{?}{8}$

e. $\frac{2}{3} = \frac{?}{6}$ **f.** $\frac{8}{12} = \frac{?}{3}$ **g.** $\frac{3}{4} = \frac{?}{8}$ **h.** $\frac{3}{5} = \frac{?}{10}$

Set 2. Addition

1.	2.	3.	4.	5.	6.
$2\frac{1}{4}$	$1\frac{5}{6}$	$2\frac{7}{8}$	$3\frac{3}{10}$	$4\frac{1}{2}$	$1\frac{3}{4}$
$\underline{1\frac{1}{2}}$	$\underline{\frac{2}{3}}$	$\underline{1\frac{3}{4}}$	$\underline{2\frac{1}{2}}$	$\underline{1\frac{1}{6}}$	$\underline{2\frac{1}{16}}$

7.	8.	9.	10.
$1\frac{1}{2}$	$2\frac{2}{5}$	$1\frac{3}{4}$	$3\frac{1}{2}$
$\underline{2\frac{1}{3}}$	$\underline{1\frac{1}{2}}$	$\underline{2\frac{1}{3}}$	$\underline{1\frac{2}{3}}$

11. $\frac{3}{8} + \frac{1}{2} + \frac{1}{4}$

12. $\frac{1}{2} + \frac{1}{3} + \frac{1}{6}$

Set 3. Subtraction

1.	2.	3.	4.	5.	6.
$\frac{7}{8}$	$2\frac{5}{6}$	$1\frac{1}{4}$	$2\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{1}{2}$
$\underline{\frac{3}{4}}$	$\underline{2\frac{1}{3}}$	$\underline{\frac{3}{4}}$	$\underline{\frac{5}{8}}$	$\underline{2\frac{4}{5}}$	$\underline{3\frac{5}{6}}$

7.	8.	9.	10.	11.	12.
$\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{3}$	$3\frac{1}{4}$	$4\frac{1}{5}$	$2\frac{2}{3}$
$\underline{\frac{1}{3}}$	$\underline{1\frac{2}{5}}$	$\underline{1\frac{1}{2}}$	$\underline{1\frac{2}{3}}$	$\underline{3\frac{1}{2}}$	$\underline{1\frac{3}{4}}$

UNIT 20

\$5	3
\$1	6
Halves	6
Quarters	8
Dimes	7
Nickels	10
Cents	15

GETTING READY TO MULTIPLY AND TO DIVIDE FRACTIONS

COUNTING MONEY BY MULTIPLYING

1. After the Scouts' food sale, Carol stacked the money and counted it. She wrote the amounts down and then multiplied to get the total for each kind of bill or coin.

Finish Carol's multiplication. →

$3 \times \$5 = \underline{\ ?\ }$
$6 \times \$1 = \underline{\ ?\ }$
$6 \times \frac{1}{2} = \underline{\ ?\ }$
$8 \times \frac{1}{4} = \underline{\ ?\ }$
$7 \times 10¢ = \underline{\ ?\ }$
$10 \times 5¢ = \underline{\ ?\ }$
$15 \times 1¢ = \underline{\ ?\ }$

2. How much is $6 \times \frac{1}{2}$? $8 \times \frac{1}{4}$?

3. How much will eight ball gloves cost at two and one-half dollars each?
Think: "$8 \times \frac{1}{2} = \underline{\ ?\ }$. $8 \times 2 = \underline{\ ?\ }$. So, $8 \times 2\frac{1}{2} = \underline{\ ?\ }$."

4. Children go to the zoo free, but grownups pay a quarter. How much will 5 tickets for mothers cost? Think: "5 quarters are $\underline{\ ?\ }$. So, $5 \times \frac{1}{4} = \frac{5}{4}$ and $\frac{5}{4} = \underline{\ ?\ }$."

5. If each of 3 children eats $\frac{1}{5}$ of a pie, how much pie will be needed for all 3? $3 \times \frac{1}{5} = \underline{\ ?\ }$

6. Multiply:

a. $4 \times \frac{1}{2}$	**d.** $3 \times \frac{1}{4}$	**g.** $8 \times \frac{1}{4}$	**j.** $4 \times \frac{1}{5}$	**m.** $3 \times 1\frac{1}{3}$
b. $6 \times \frac{1}{3}$	**e.** $5 \times \frac{1}{5}$	**h.** $9 \times \frac{1}{3}$	**k.** $4 \times \frac{1}{8}$	**n.** $2 \times 1\frac{1}{2}$
c. $5 \times \frac{1}{2}$	**f.** $6 \times \frac{1}{2}$	**i.** $3 \times \frac{1}{2}$	**l.** $2 \times \frac{1}{2}$	**o.** $4 \times 2\frac{1}{2}$

HOW MANY ALL TOGETHER WHEN EACH IS A FRACTION

1. Each of 12 girls needs $\frac{2}{3}$ yd. of ribbon. How many yards will be needed for all?

Think: "*If each gets 2 thirds, 12 girls will need 12 × 2 thirds.*"

$12 \times \frac{2}{3} = \frac{24}{3}$

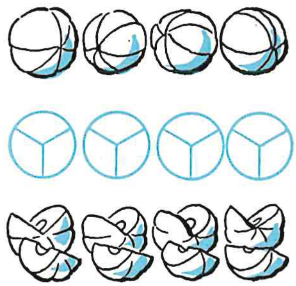
$\frac{24}{3} = 8$

8 yd. ribbon

2. A candy recipe calls for $\frac{3}{4}$ cup of sugar. Ken's mother is making 4 times the amount. How much sugar does she need?

Think: "*4 × 3 fourths* = _?_ *fourths.*" $4 \times \frac{3}{4} =$

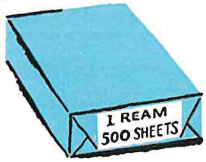
3. Tom has 4 cantaloupes to divide among 6 boys. His father gave him a hint. "Divide each one into thirds," he said.



Tom says each boy will have 2 of the thirds. 6×2 thirds $= \frac{12}{3} =$ _?_

4. A group of 12 boys are planning a trip to the museum. Carfare and food will cost \$9. "Each boy should bring 3 quarters," said Joe. Was he right? 12 × 3 fourths = _?_ fourths. Are 36 quarters \$9?

5. Miss Carter's class used 200 sheets of paper last week. "200 sheets of a 500-sheet ream is $\frac{200}{500}$, which is $\frac{2}{5}$ of a ream," said Miss Carter. At the rate of $\frac{2}{5}$ ream a week, how many reams will a class use in 40 weeks? $40 \times \frac{2}{5} =$



Do you think 40 × 2, and then write the product over the 5? Do you then divide 80 by 5?

6. Multiply:

a. $12 \times \frac{2}{3}$	**c.** $8 \times \frac{3}{4}$	**e.** $5 \times \frac{2}{5}$	**g.** $6 \times \frac{2}{3}$	**i.** $15 \times \frac{3}{5}$
b. $8 \times \frac{3}{8}$	**d.** $4 \times \frac{2}{4}$	**f.** $12 \times \frac{3}{4}$	**h.** $2 \times \frac{3}{4}$	**j.** $2 \times \frac{2}{3}$

WHEN MULTIPLIERS ARE FRACTIONS

1. How many inches are there in:

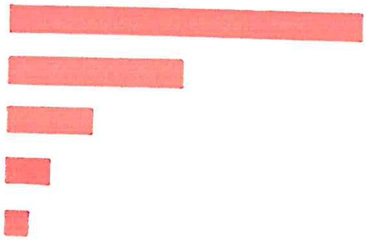
4 feet? $4 \times 12 = \underline{\ ?\ }$

2 feet? $2 \times 12 = \underline{\ ?\ }$

1 foot? $1 \times 12 = \underline{\ ?\ }$

$\frac{1}{2}$ foot? $\frac{1}{2} \times 12 = \underline{\ ?\ }$

$\frac{1}{4}$ foot? $\frac{1}{4} \times 12 = \underline{\ ?\ }$



As the multipliers get smaller, from 4 to 2, to 1, to $\frac{1}{2}$, to $\frac{1}{4}$, what happens to the products above?

Is $\frac{1}{2} \times 12$ the same as $\frac{1}{2}$ of 12?

2. A frozen pudding recipe takes 12 crushed cookies. Does a double recipe take 2 of the 12's?

Will $\frac{3}{4}$ recipe take $\frac{3}{4}$ of 12 cookies?

Do 3 of the 12's = 36? Does $12 \times 3 = 36$?

Is $\frac{3}{4}$ of 12 the same as $\frac{3}{4} \times 12$?

Do you multiply $\frac{3}{4} \times 12$ the same as $12 \times \frac{3}{4}$?

How many is $12 \times \frac{3}{4}$? Do you multiply 12×3 and divide by 4?

Then $\frac{3}{4} \times 12 = \frac{3 \times 12}{4} = \frac{36}{4} = 9.$ Does $\frac{3}{4}$ of $12 = 9$?

How many is 1×12? Will $\frac{3}{4} \times 12$ be less than 12?

• In thinking about fractions, *of* and $\times$ mean the same.

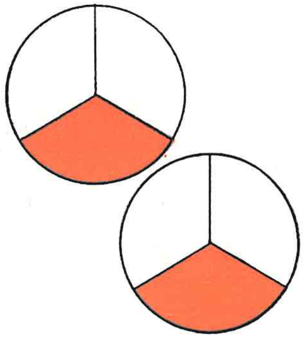
$$\begin{array}{rl} 8 & \leftarrow \text{multiplicand} \\ \times\ \frac{1}{2} & \leftarrow \text{multiplier} \\ \hline 4 & \leftarrow \text{product} \end{array}$$

3. When you multiply two numbers, is the product always larger than either number?

4. Which of these products will be more and which will be less than the multiplicand?

a	b	c	d	e	f	g	h
3	4	5	6	8	6	10	8
$\times\ \frac{1}{3}$	$\times 1\frac{1}{2}$	$\times 2$	$\times\ \frac{2}{3}$	$\times\ \frac{3}{4}$	$\times 2\frac{1}{3}$	$\times 1\frac{1}{2}$	$\times\ \frac{1}{4}$

SEVERAL PARTS OF A NUMBER



1. What is $\frac{1}{3}$ of 6? $\frac{1}{4}$ of 12? $\frac{1}{5} \times 10$?
Tell how you found each answer.

2. How much is 2 divided by 3?

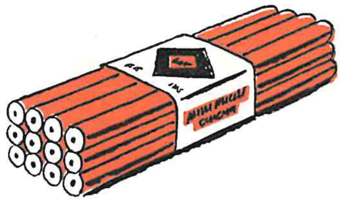
3. What does the line between the numerator and the denominator mean?

$$\longrightarrow \frac{2}{3}$$

4. What is the answer to each question?

a. $\frac{8}{2} = \underline{\ ?\ }$ **b.** $\frac{12}{4} = \underline{\ ?\ }$ **c.** $\frac{6}{2} = \underline{\ ?\ }$

d. $\frac{10}{5} = \underline{\ ?\ }$ **e.** $\frac{16}{8} = \underline{\ ?\ }$



5. How many are 2 dozen pencils?
How many are $\frac{2}{3}$ dozen pencils?
How many are $\frac{3}{4}$ dozen pencils?
To answer each question above, you multiply.
$2 \times 12 = \underline{\ ?\ }$ $\frac{2}{3} \times 12 = \underline{\ ?\ }$ $\frac{3}{4} \times 12 = \underline{\ ?\ }$

You may solve examples like these in two ways. You may multiply first, or you may divide first.

Multiply first: $\frac{2}{3} \times 12 = \frac{24}{3} = 8$
Divide first: $\frac{2}{3}$ of $12 = 2 \times \frac{12}{3} = 2 \times 4 = 8$

The answer is the same.

6. Solve these without pencil and paper if you can:

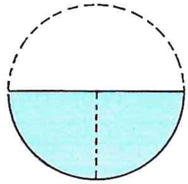
Multiply first: **a.** $\frac{2}{3} \times 6$ **b.** $\frac{3}{4} \times 12$ **c.** $\frac{2}{5} \times 10$ **d.** $\frac{2}{6} \times 12$
Divide first: **e.** $\frac{3}{4} \times 8$ **f.** $\frac{3}{5} \times 10$ **g.** $\frac{2}{3} \times 12$ **h.** $\frac{3}{8} \times 16$

7. Write these another way and find the answers:

a. 2 thirds of 6
b. 3 fourths of 8
c. 2 fifths of 10
d. 3 sixths of 12
e. 5 eighths of 16
f. 4 fifths of 25

A FRACTION MAY BE DIVIDED INTO EQUAL PARTS

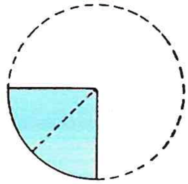
A



1. Cut a whole circle into 2 equal parts. How much is 1 divided by 2?

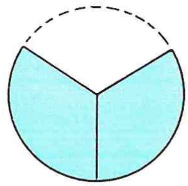
2. Cut $\frac{1}{2}$ of a circle into 2 equal parts. What is $\frac{1}{2}$ divided by 2?

B



3. Cut $\frac{1}{4}$ of a circle into 2 equal parts. What is $\frac{1}{4}$ divided by 2?

C



4. How much is two thirds of a circle divided into 2 equal parts? The colored part of *C* is $\frac{2}{3}$. How much is one half of two thirds?

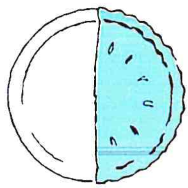
5. How much is 2 equal pieces of anything divided by 2? Is it 1 piece?

6. How much is 4 equal pieces of something divided by 2? Is it 2 pieces?

7. How much is $\frac{1}{2}$ pie divided by 2?

8. How much is $\frac{2}{4}$ pie divided by 2?

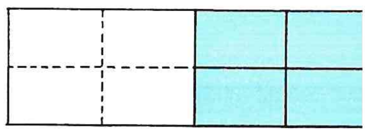
D



9. Can you divide parts of something as you divide whole numbers?

a. What is 4 divided by 2?

b. Then what is $\frac{4}{8}$ divided by 2? →



c. What is $2 \div 2$? Then, what is $\frac{2}{4} \div 2$?

10. Can you think the answers for these in your head? If you have trouble, draw circles to help you.

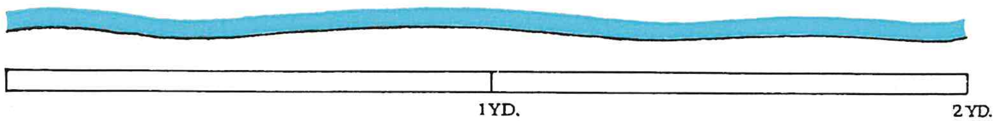
a. $\frac{2}{3} \div 2$ **b.** $\frac{1}{2} \div 2$ **c.** $\frac{1}{3} \div 2$ **d.** $\frac{2}{5} \div 2$

e. $\frac{3}{4} \div 3$ **f.** $\frac{1}{2} \div 3$ **g.** $\frac{4}{5} \div 2$ **h.** $\frac{3}{6} \div 3$

A NUMBER MAY BE MEASURED BY A FRACTION

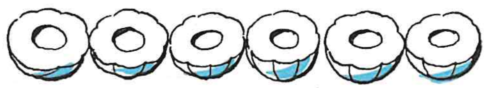
1. Each girl needs $\frac{1}{2}$ yd. of ribbon for her tie. Bonnie has 2 yd. She has enough for how many girls?

How many pieces $\frac{1}{2}$ yd. long can Bonnie cut from 2 yd.?



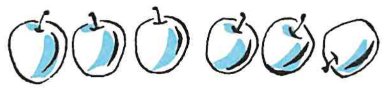
2. Can Bonnie say, "2 yd. measured by $\frac{1}{2}$ yd. is 4"? Can she say, "2 yd. divided by $\frac{1}{2}$ yd. = 4"?

3. What is 3 melons measured by $\frac{1}{2}$ melon?



4. If you have 6 apples and give 2 to each person, how many will get 2 apples?

Do you divide 6 by 2?

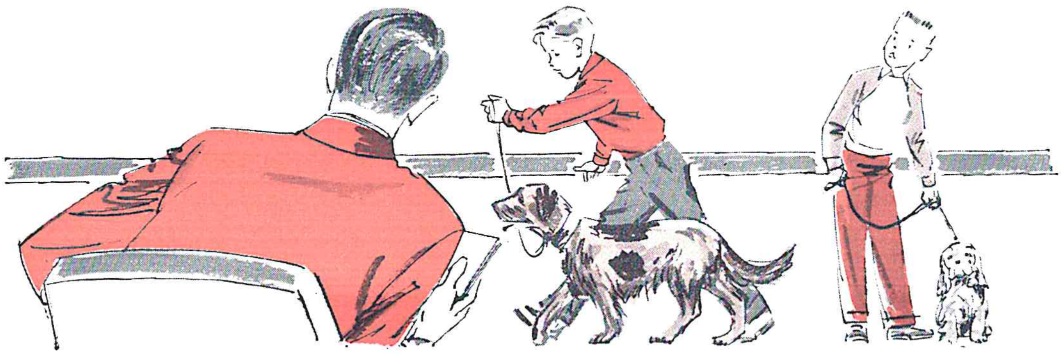


5. If you have 4 apples and each person gets $\frac{1}{2}$ apple, how many persons will get $\frac{1}{2}$ apple?

Do you measure 4 by $\frac{1}{2}$? Is that dividing?

6. How many 3's are there in 12? 4's in 20? 8's in 48? How many $\frac{1}{2}$'s are there in 2? in 4? in 3? in 5?

When a whole number is divided by a proper fraction, is the answer more than the number?



AN AVERAGE MAY BE A MIXED NUMBER OR EVEN A FRACTION

1. If three children own 4 pets, what is each one's share? More than 1? As many as 2?

2. The children in our room own an average of $\frac{3}{4}$ pet. Does each own a part of a pet?

3. If 4 hens lay 3 eggs, what is the average for them? Could you say they average $\frac{3}{4}$ egg?

4. Patty's hen averages laying $4\frac{1}{2}$ eggs a week. Does a hen lay a half egg some weeks?

5. Jim says he eats an egg and a half a day. What do you think he means?

6. At one place on the desert the rainfall is about 6 in. in 12 months. What is the average monthly rainfall? What is $6 \div 12$? Write it as a fraction. Is the dividend the numerator? Can you reduce the terms of $\frac{6}{12}$? Is the average $\frac{1}{2}$ in.?

7. Find the averages for persons, months, or days:

a. 6 apples for 4 boys.
b. 7 boys read 8, 6, 0, 5, 3, 0, 16 books.
c. 6 girls have 9, 7, 4, 10, 4, and 6 dolls.
d. The rainfall is 4 inches in 12 months.
e. 3 boys have 2 melons.
f. Harold caught 4, 0, 3, and 3 fish in 4 days.

UNIT TEST

Set 1. Meanings

1. 8×2 pieces are _?_ pieces. So 8×2 fourths are _?_ fourths.

2. Is $4 \times 2\frac{1}{2}$ the same as $4 \times \frac{1}{2}$ added to 4×2?

3. When you multiply a fraction by a whole number, do you multiply the numerator, or the denominator, or both of them by the whole number? Think about $4 \times \frac{1}{2}$.

4. Is a product always greater than either the multiplicand or the multiplier?

5. What does the line between the 2 and 4 mean in $\frac{2}{4}$?

6. In $\frac{12}{4}$, which number is the dividend? the divisor?

7. In the fraction $\frac{4}{5}$, which number tells the size of the parts? the number of parts?

a. If you divide the number of parts in $\frac{4}{5}$ among 4 children, how many parts will each one get?

b. What will be the size of each one's part?

8. How many 3-yard jumping ropes can you measure from 10 yards? Will some rope be left over?

9. Can you measure $2\frac{1}{2}$-yard ropes from 10 yards? Measure mentally $2\frac{1}{2}$, another $2\frac{1}{2}$, and so on.

What is $10 \div 2\frac{1}{2}$?

Set 2. Multiplication and Division

1. $10 \times \frac{1}{2}$	**7.** $\frac{1}{5} \times 10$	**13.** $\frac{1}{2} \div 2$
2. $8 \times \frac{1}{4}$	**8.** $\frac{3}{4} \times 8$	**14.** $2 \div 4$
3. $6 \times \frac{1}{3}$	**9.** $\frac{2}{3} \times 6$	**15.** $\frac{1}{4} \div 2$
4. $6 \times \frac{2}{3}$	**10.** $2 \times 2\frac{1}{2}$	**16.** $\frac{2}{3} \div 2$
5. $10 \times \frac{3}{5}$	**11.** $4 \times 1\frac{1}{4}$	**17.** $\frac{4}{5} \div 2$
6. $12 \times \frac{3}{4}$	**12.** $5 \times 2\frac{1}{8}$	**18.** $\frac{6}{8} \div 3$

19. 2 measured by $\frac{1}{2}$ = **20.** 5 measured by $\frac{1}{2}$ =

MEASURING AREA

THE SQUARE INCH

1. Dave needs a piece of leather 3 inches wide and 5 inches long. Leather is sold by the **square inch.** What is a square inch? How many square inches of leather will Dave need?

a. Cut a piece of squared paper into strips one inch wide. Cut the strips into pieces one inch long. Are the pieces 1-inch squares? You will need 32 of them.

b. Cut a rectangle the size of the leather Dave needs. A short way to write the size is *3 in. by 5 in.*

c. Now lay your 1-inch squares on the rectangle to cover it. How many squares cover it? Will Dave need 15 square inches of leather?

• You have used a new unit of measure. Its name is **square inch.** It is one of the measures of **area**, or surface.

2. Measure and cut paper rectangles of these sizes: 2 in. by 4 in.; 3 in. by 4 in.; 4 in. by 4 in.; 4 in. by 5 in.; 4 in. by 8 in. You can cut them all from a sheet of paper $8\frac{1}{2}$ in. by 11 in. Draw them carefully before you cut them.

a. Lay 1-inch squares to cover the rectangle that is 2 in. by 4 in. How many squares cover it?

b. How many squares are needed to cover each of the other rectangles?

c. Draw lines across your rectangles, 1 in. from the edge and 1 in. apart, both directions. Are the spaces square inches? The area of each rectangle is how many square inches?

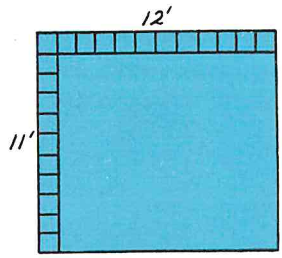
MEASURING AREAS BY SQUARE FEET

Dorothy wants to know the area of the floor surface of her room at home.

The amount of floor surface of a room is called its area. Room areas are usually measured by **square feet.**

1. What is a **square foot**? Use squared paper. Measure and cut a piece 1 foot wide and 1 foot long. Is it square? This measure is called a square foot.

Dorothy cut some square feet from paper to measure the area of her room. She laid 11 of the square feet across the width of her room. She laid 12 of them along the length of it.



DOROTHY'S ROOM

"I don't need to lay down any more square feet," she said. "I can see that I can lay down 12 rows of 11 square feet. $12 \times 11 = 132$. The area of my room is 132 square feet."

When you measure area, you use measures of two directions, length and width.

The length and the width are called the **dimensions** of the space.

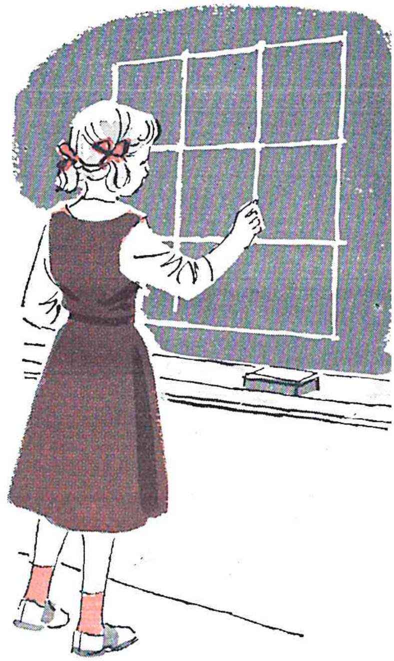
2. The dimensions of Jack's room are 9 ft. by 12 ft. How many square feet could he lay across the width? How many rows of them could he lay? What is the area of Jack's room? Is it 12×9? Is it 108 square feet?

3. Tell how to find the areas of these rooms:

a. 8 ft. by 11 ft. **b.** 12 ft. by 15 ft. **c.** 14 ft. by 14 ft.

> The number of squares in a rectangle equals the number of squares in one row across one side times the number of rows.

THE SQUARE YARD

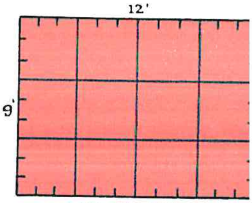


1. Draw a square on the floor with chalk. Make it 1 yard wide and 1 yard long. This square is called a **square yard.**

2. Lay square feet of paper on the square yard. How many square feet are needed to cover it?

3. Draw a square yard on the chalkboard. Draw lines across it 1 foot from each of the 4 edges. How many smaller squares are there in the square yard? Are the smaller squares square feet? Are there 9 square feet in the square yard?

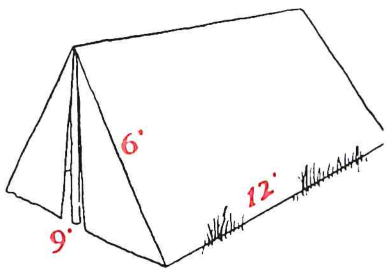
4. This rug is 9 ft. by 12 ft. How many square yards could you lay across the width? How many rows of them could you lay along the length? How much would the rug cost at $10 per square yard?



A 9'x12' RUG

5. How many square yards of linoleum are needed for a room 12 ft. by 18 ft.?

6. How many square yards of canvas will be needed for both sides of this pup tent?



7. How many square feet are in each of these areas?

a. 6 ft. by 10 ft.	**e.** 9 ft. by 15 ft.	**i.** 15 ft. by 15 ft.
b. 8 ft. by 4 ft.	**f.** 6 ft. by 12 ft.	**j.** 20 ft. by 25 ft.
c. 9 ft. by 6 ft.	**g.** 30 ft. by 40 ft.	**k.** 24 ft. by 36 ft.
d. 10 ft. by 12 ft.	**h.** 20 ft. by 30 ft.	**l.** 48 ft. by 25 ft.

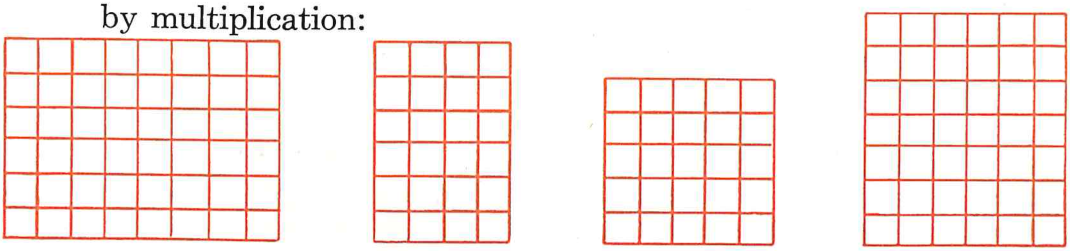
PRACTICE IN FINDING AREAS

• Some abbreviations for square measures are:

Square inch is sq. in. Square foot is sq. ft.

Square yard is sq. yd.

1. Find the number of squares in each of these areas by multiplication:



A B C D

• You can use the sign $\times$ to mean *by*. The areas above are: *A*, 8×6; *B*, 4×6; *C*, 5×5; *D*, 6×7. We don't know whether the squares are inches, feet, or yards.

What does the sign (′) mean?

2. What will a porch mat cost at \$3 a sq. yd.? The dimensions are $9' \times 15'$. Draw a picture to help you.

3. What will a hall rug cost at \$10 a sq. yd.? The dimensions are $4\frac{1}{2}' \times 7\frac{1}{2}'$. Draw a picture to help.

• Larger areas are often measured by **square miles.** Think of a distance of a mile. Then think of a square made that big. In some states square miles are marked off with roads. These squares are called **sections.**

4. How many square miles are there in an area that is 10 miles wide and 25 miles long?

5. How many square miles will there be in these areas? **Mi.** is the abbreviation for **mile** or **miles.**

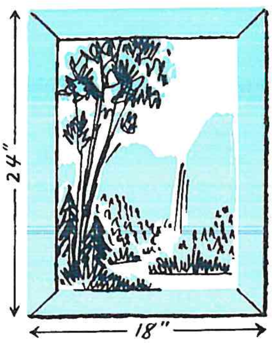
a. 8 mi. $\times$ 40 mi.
b. 16 mi. $\times$ 40 mi.
c. 32 mi. $\times$ 40 mi.
d. 40 mi. $\times$ 40 mi.
e. 80 mi. $\times$ 40 mi.
f. 40 mi. $\times$ 300 mi.
g. 60 mi. $\times$ 300 mi.
h. 75 mi. $\times$ 300 mi.
i. 100 mi. $\times$ 300 mi.
j. 200 mi. $\times$ 300 mi.
k. 10 mi. $\times$ 5 mi.
l. 10 mi. $\times$ 50 mi.
m. 10 mi. $\times$ 500 mi.
n. 100 mi. $\times$ 500 mi.
o. 200 mi. $\times$ 500 mi.

PERIMETERS

1. Beth's sewing club is making napkins to use for parties. Beth is going to trim the borders of hers. About how much rickrack will it take for each napkin which is 9 in. by 9 in.?

The distance around each napkin is how many inches?

2. How far is it around napkins which are 15 in. square?



The distance around an area, or the border, is called the **perimeter.**

3. What is the perimeter of a picture that is 18 in. wide and 24 in. high?

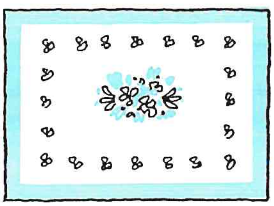
a. Work this problem by addition of inches first.

b. Now work it by multiplication and addition.

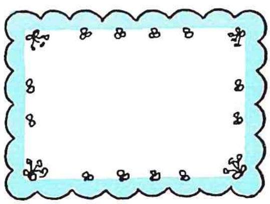
c. Now change the inches to feet and find the perimeter.

4. A children's softball diamond is 30 ft. from each base to the next. How far must a boy go to run all the way round?

A



B



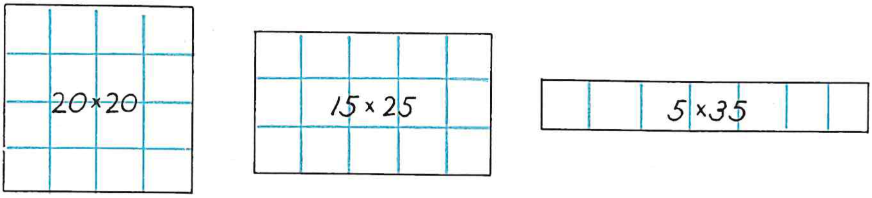
5. Tablecloths *A* and *B* are the same size. Which has the shorter border?

PERIMETERS (continued)

1. Chuck is tacking cord round a chart. The chart is 20 in. wide and 28 in. long. How many feet long will the cord need to be?

2. About how many feet of frame would be needed for a picture that is 30 in. long and 24 in. wide? Add 6 in. to allow for corners.

3. What are the perimeters of these rectangles? Which rectangle has the largest area?



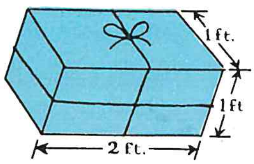
4. Find the perimeters of these rectangles in feet:

a. 27 in. by 15 in.	**c.** 32 in. by 31 in.
b. 6 ft. by 8 ft.	**d.** 4 yd. by $2\frac{1}{2}$ yd.

5. Find the perimeters of these rectangles in yards:

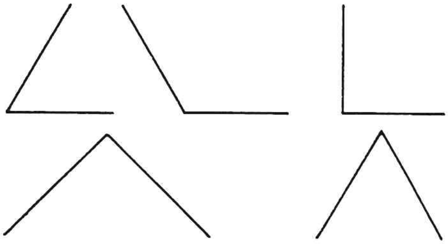
a. 5 ft. $\times$ 7 ft.	**c.** $4\frac{1}{2}$ ft. $\times$ 12 ft.
b. 6 ft. $\times$ 8 ft.	**d.** 10 ft. $\times$ $8\frac{1}{2}$ ft.

6. This box is 1 ft. high, 1 ft. wide, and 2 ft. long. How long is the ribbon if 2 ft. is used for tying the bow?



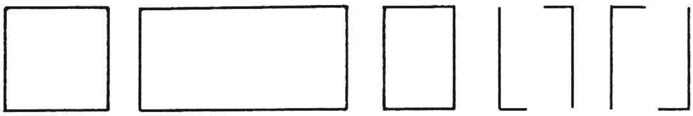
If you have 40 ft. of fence to make a pen for your pup, what shape rectangle will give you most space? Jim thinks a round pen would make more area than a square pen. Is he right?

ANGLES (Optional)



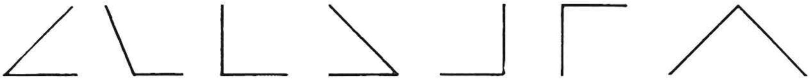
- The openings between the five pairs of lines at the right are called **angles.**

- Angles at square corners are called **right angles.** The angles in the figures just below are all right angles:



1. Why is the boy in the picture using a carpenter's square?

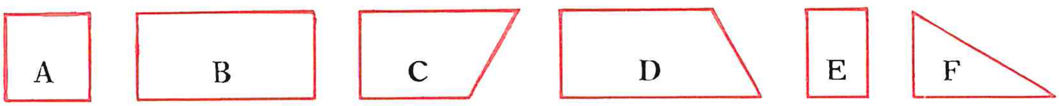
2. Which of these angles are right angles?



A B C D E F G

- A **rectangle** has four sides and four right angles.

3. Which of the figures below are rectangles?

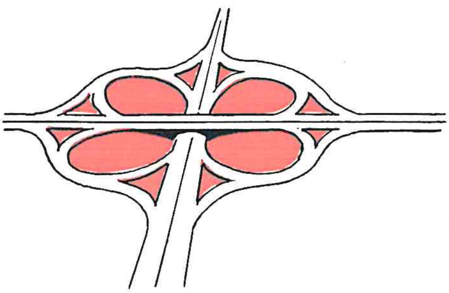


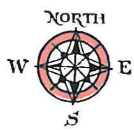
- A **triangle** has three angles.

4. Which is a triangle in Number 3 above?

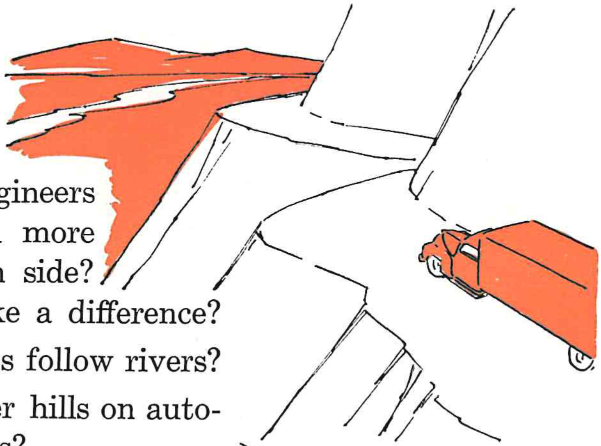
5. All squares are rectangles because they have four right angles. Are all rectangles squares?

6. Square corners in roads or streets are hard to turn at high speed. Can you figure out how to make the following turns on this highway? Use the compass. Would you first turn right or left to go from: **a.** east to north? **b.** west to north? **c.** south to west?





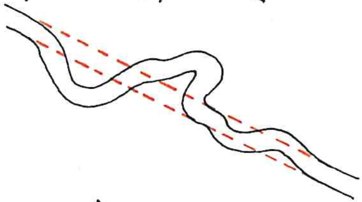
ROAD ENGINEERS, ANGLES, AND LINES



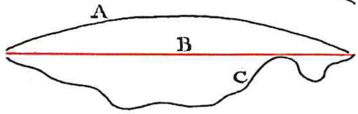
1. Why do road engineers make roads longer and more winding up a mountain side? Does the steepness make a difference?

2. Why do railroads follow rivers?

3. Are there steeper hills on automobile roads or railroads?

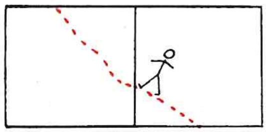


4. Have you ever watched road builders straightening out a curve? The dotted line shows the new road. Why, do you think, is it being built?



5. What kind of line is the shortest distance between two points? Is it **A, B,** or **C**?

6. Why do people cut across vacant lots?



PRACTICE

1	2	3	4	5
$22\overline{)88}$	$40\overline{)85}$	$60\overline{)180}$	$80\overline{)326}$	$52\overline{)104}$
6	7	8	9	10
$72\overline{)269}$	$24\overline{)72}$	$56\overline{)169}$	$30\overline{)960}$	$21\overline{)483}$
11	12	13	14	15
$30\overline{)635}$	$45\overline{)1935}$	$82\overline{)1899}$	$32\overline{)7397}$	$42\overline{)9702}$
16	17	18	19	20
$73\overline{)1460}$	$65\overline{)2608}$	$62\overline{)6515}$	$92\overline{)46368}$	$82\overline{)89380}$

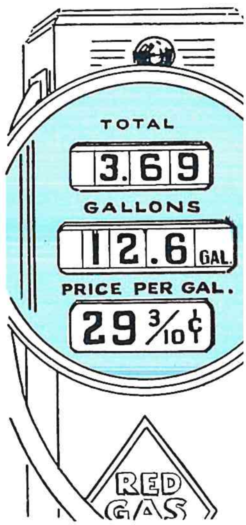
UNIT 22

DECIMAL FRACTIONS

DECIMAL FRACTIONS AT A FILLING STATION

Ann keeps the gasoline purchase and mileage record on trips. Her dad says she will own a car some day and should learn how to keep records.

1. Ann likes to watch the numbers turn on a filling station pump. The cents' digit moves steadily. When 9 goes by and 0 comes up, the dimes' wheel is turned one number. When the dimes' 9 goes by and its 0 comes up, the dollars' wheel is turned one number.



2. The right-hand wheel in the gallons' window that turns steadily as the pump runs, tells tenths of a gallon. 12.6 means $12\frac{6}{10}$ gallons. Whenever the tenths' wheel goes round once, it turns a new digit at its left into the window. This means 1 more gallon has been pumped.

Date	Miles	Gallons	Per Gal.	Total
June 3	22416.5	Full		
3	22598.9	8.5	$28\frac{3}{10}$¢	\$2.41
4	22726.4	10.3	$30\frac{8}{10}$¢	3.17
4	22891.2	12.6	$29\frac{3}{10}$¢	3.69

3. Ann's record shows that the gasoline tank was full when the trip started on June 3. Dad bought 8.5 (eight *and* five tenths) gallons, 10.3, and 12.6. How much did he buy in all? →

$$\begin{array}{r} 8.5 \\ 10.3 \\ 12.6 \\ \hline ??.4 \end{array}$$

4. Read the car mileage that Ann wrote at each station.

UNDERSTANDING TENTHS

1. How much is 10×1? 10×10? What happens to the value and to the position of the 1 in the multiplicand when it is multiplied by 10?

$$\begin{array}{r}1\\ \times 10\\ \hline 10\end{array}\qquad\begin{array}{r}10\\ \times 10\\ \hline 100\end{array}\qquad\begin{array}{r}100\\ \times 10\\ \hline 1000\end{array}$$

2. Tell what happens in each of these divisions:

a. $10\overline{)1000}$ with quotient 100 **b.** $10\overline{)100}$ with quotient 10 **c.** $10\overline{)10}$ with quotient 1

3. What are the answers for these?

$$\begin{array}{r}2\\ \times 10\\ \hline\end{array}\qquad\begin{array}{r}20\\ \times 10\\ \hline\end{array}\qquad\begin{array}{r}200\\ \times 10\\ \hline\end{array}\qquad 10\overline{)2000}\qquad 10\overline{)200}\qquad 10\overline{)20}$$

4. Study the chart at the right. The number under it has 4 twos. Read it. As you move left one place, what happens to the value of the 2?

2000	200	20	2
2	2	2	2

• Our number system is called a **decimal** system because it is a system of tens. The value of each digit is multiplied by 10 as the digit is moved one place to the left. The value of each digit is divided by 10 as the digit is moved one place to the right.

5. Read these money numbers: \$10.00, \$1.00, \$0.10, \$0.01. What happens to the value of the 1 as it is moved a place to the right?

6. Read: *\$22, \$2200; \$22.00.* How are \$22.00 and \$2200 different?

• The point shows where the ones' place is. The point is called the **decimal point.**

7. This number is read *fifty-six and two tenths*. The decimal point is read *and*. Read these numbers. Then write them in words.

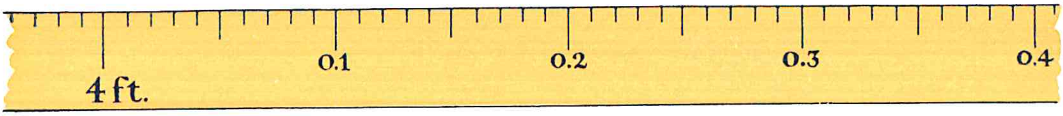
tens	**ones**	tenths
→ 5	6.	2

67.2 89.4 562.1 640.7 42.6 14.3 26.5

UNDERSTANDING HUNDREDTHS

1. Mrs. Wilson asked the pupils in her class, "How big is one hundredth?" Jim, sharp as usual, asked, "One hundredth of what?" Why did he ask that?

2. The ruler below shows tenths (0.1) and hundredths (0.01) of a foot. Surveyors use hundredths to measure distances.



Each small space above is 0.01 ft. How many hundredths are in 1 tenth?

A zero in ones' place with a one at its *left* (10) means *ten.* A zero in ones' place with a decimal point and 1 at its *right* (0.1) means *1 tenth.* A zero with a decimal point and with a zero and one at the right of the point (0.01) means *one hundredth.*

3. Read these: 100, 0.01; 200, 0.02; 300, 0.03.

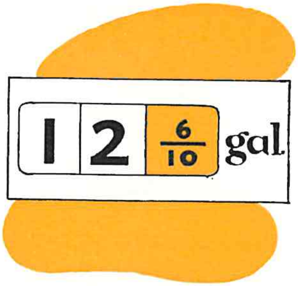
4. Mrs. Wilson's class measured part of a ream of paper to get a stack 1 in. thick. It took 300 sheets for 1 in. The pupils found that 1 hundredth of 300 is 3. So 3 sheets of their paper together were 0.01 in. thick.

5. The class marked ten feet on the chalkboard with a surveyor's tape. Then they marked one foot into tenths. Each foot was 0.1 of the whole length and each small space was 0.01 of it.

"I know how big one hundredth always is," said Jim. with excitement. "It is always one tenth of one tenth."

Can you find one hundredth of anything by dividing one tenth of it into ten parts?

6. Change to tenths: 0.10 0.30 0.60 0.80



DECIMAL NUMBERS

Many filling station pumps show the number of gallons of gasoline this way. No decimal point is needed because the denominator *10* shows tenths.

When a fraction is written with the denominator showing, it is called a **common fraction.** Any number may be a denominator. $\frac{3}{5}$, $\frac{1}{2}$, $\frac{4}{10}$, and $\frac{25}{100}$ are common fractions. Name the denominators.

When a fraction is written with a decimal point, it is a **decimal fraction.** It is often called a *decimal* for short. The denominator is shown by the place value of the numbers. Name the denominator: .2

A whole number and a decimal fraction together, as 27.8, is a **mixed decimal.** It is often called a *decimal* for short. Numbers, such as 285, are **decimal whole numbers.** They are called *numbers* for short.

hundreds	tens	**ones**

1. What place is at the left of ones' place? at the left of tens' place?

2. You have used a decimal point before in writing dollars and cents. Do 100 cents equal \$1.00? One cent is $\frac{1}{100}$ dollar. 1 cent = \$0.01

3. What place is at the right of ones' place? at the right of tenths' place? $\frac{1}{10}$ of $\frac{1}{10} = \frac{1}{100}$

hundreds	tens	**ones**	tenths	hundredths
3	5	4.	2	6

4. This number is read *three-hundred fifty-four and twenty six hundredths.*

5. Read these decimals: 243.18 46.10 95.06 531.45 180.9 71.50 29.25 34.08 68.3

6. Write the above numbers in words.

ADDING AND SUBTRACTING DECIMAL FRACTIONS

A.

John Parker	
MAY 2	$ 1.35
MAY 9	2.17
MAY 16	.98
MAY 23	2.04

John writes his earnings in a book. He calls it his *account* book. In *A* are his entries for four weeks.

1. How much did John earn the first two weeks?

2. How much did he earn the first three weeks?

3. How much did John earn all together?

John writes money with decimal fractions, because dimes and cents are tenths and hundredths of a dollar.

Look at Table *B*.

4. How much did it rain on Sunday and Monday together? You add one and fifteen hundredths to six hundredths. Add and carry just the same as with money.

$$\begin{array}{r} 1.15 \\ .06 \\ \hline 1.21 \end{array}$$

B.

RAINFALL	
SUN.	1.15 in.
MON.	.06 in.
TUES.	—
WED.	—
THUR.	—
FRI.	.25 in
SAT.	1.68 in

5. Which three days had no rain?

6. How much did it rain all week?

Look at the railroad time table.

7. In the miles column are the distances from Center to six other towns. How far is it from Kirk to Hoburg? Subtract 2.4 from 11.9. Did you get 9.5?

MILES	TABLE 6	TRAIN NO. 55
0.0	Lv. Center	2:15
2.4	Lv. Kirk	2:22
6.8	Lv. Troy	2:35
11.9	Ar. Hoburg	2:50
11.9	Lv. Hoburg	2:55
21.6	Lv. Miner	3:20
29.4	Lv. Harmon	3:40
37.9	Ar. Union	4:00

8. Find the distance from Troy to Hoburg; Miner to Union.

9. How long does it take to go from Center to Union?

▶ MULTIPLYING AND DIVIDING TENTHS

BEGIN	END
1420	1425

1. Jerry measured the distance to school with his bicycle cyclometer. How far is it? →

2. How far does Jerry go from home to school and back each day? One way is 0.5 mile. Multiply 2 × 0.5. 2 × five tenths = 10 tenths. Is ten tenths one whole?

$$\begin{array}{r} 0.5 \\ \underline{2} \\ 1.0 \end{array}$$

3. George's round trip to school each day is 1.5 miles. How far must he go in 5 days?

Multiply 5 × 1.5. Then put in the decimal point to show tenths as in the multiplicand.

$$\begin{array}{r} {}^{2} \\ 1.5 \\ \underline{5} \\ 7.5 \end{array}$$

4. The first 4 days Henry rode his new bicycle 25.2 miles. What was his daily average?

$$\begin{array}{r} 6.3 \\ 4\overline{)25.2} \\ \underline{24} \\ 12 \\ \underline{12} \end{array}$$

What is your estimate? Will it be less than 25 miles? Why? Will it be more than 6 miles? Why?

• When you divide tenths by a whole number, place the decimal point in the quotient to show tenths.

5. Multiply or divide:

a. $\begin{array}{r} 4.3 \\ \underline{3} \end{array}$ **b.** $\begin{array}{r} 6.7 \\ \underline{8} \end{array}$ **c.** $\begin{array}{r} 12.6 \\ \underline{.5} \end{array}$ **d.** $\begin{array}{r} 7.4 \\ \underline{23} \end{array}$ **e.** $3\overline{)4.8}$ **f.** $7\overline{)58.8}$

g. $\begin{array}{r} 6.2 \\ \underline{4} \end{array}$ **h.** $\begin{array}{r} 7.5 \\ \underline{9} \end{array}$ **i.** $\begin{array}{r} 43.7 \\ \underline{8} \end{array}$ **j.** $\begin{array}{r} 3.6 \\ \underline{42} \end{array}$ **k.** $6\overline{)14.4}$ **l.** $9\overline{)67.5}$

m. $\begin{array}{r} 3.5 \\ \underline{5} \end{array}$ **n.** $\begin{array}{r} 8.9 \\ \underline{7} \end{array}$ **o.** $\begin{array}{r} 75.6 \\ \underline{9} \end{array}$ **p.** $\begin{array}{r} 5.4 \\ \underline{13} \end{array}$ **q.** $5\overline{)37.5}$ **r.** $4\overline{)34.4}$

6. Find the sums:

a. $\frac{1}{8} + \frac{1}{4}$ **b.** $\frac{1}{8} + \frac{1}{2}$ **c.** $\frac{1}{2} + \frac{1}{4}$ **d.** $\frac{1}{4} + \frac{3}{8}$ **e.** $\frac{3}{8} + \frac{1}{2}$

f. $\frac{3}{4} + \frac{1}{8}$ **g.** $\frac{3}{4} + \frac{3}{4}$ **h.** $\frac{1}{2} + \frac{3}{4}$ **i.** $\frac{3}{8} + \frac{3}{4}$ **j.** $\frac{1}{4} + \frac{7}{8}$

MULTIPLYING AND DIVIDING HUNDREDTHS

1. Near Ed's house the surveyors are staking out new lots for houses. Ed saw the blueprint. One block is 261.75 ft. long. It will be divided into 5 lots. How wide will the surveyors mark each lot?

Ed thought, "Cents are hundredths of a dollar. So you would divide hundredths of a foot the way you divide hundredths of a dollar."

- When you divide or multiply hundredths by a whole number, place the decimal point to show hundredths in the answer.

2. Divide 261.75 by 5. Then check the answer. Multiply hundredths the same way you multiply dollars and cents, because cents are hundredths, too. Place the decimal point in the answer to show hundredths.

$$5\overline{)261.75}^{\,52.35}$$

52.35 ft. wide

3. Tell what happened in these examples:

a. $5\overline{)7.15}^{\,1.43}$ $\quad 1.43 \times 5 = 7.15$

b. $8\overline{)27.36}^{\,3.42}$ $\quad 3.42 \times 8 = 27.36$

c. $7\overline{)15.75}^{\,2.25}$ $\quad 2.25 \times 7 = 15.75$

PRACTICE

1. $3\overline{)6.69}$	**2.** $9\overline{)38.25}$	**3.** $23\overline{)74.75}$	**4.** $28\overline{)95.76}$
5. $4\overline{)9.28}$	**6.** $8\overline{)25.20}$	**7.** $32\overline{)133.12}$	**8.** $26\overline{)108.94}$
9. $6\overline{)19.44}$	**10.** $4\overline{)16.24}$	**11.** $25\overline{)93.00}$	**12.** $15\overline{)49.35}$
13. $5\overline{)31.85}$	**14.** $8\overline{)29.60}$	**15.** $12\overline{)37.80}$	**16.** $14\overline{)44.52}$
17. $2\frac{1}{2} + \frac{3}{4}$	**18.** $2\frac{3}{4} + \frac{3}{8}$	**19.** $2\frac{3}{8} + 1\frac{1}{4}$	**20.** $1\frac{5}{8} + 2\frac{1}{2}$

UNIT TEST

Add:

1.	**2.**	**3.**	**4.**	**5.**	**6.**
7.6	6.6	65.8	65.9	54.8	75.5
8.3	7.8	6.5	99.5	78.9	69.8
9.7	5.7	98.8	57.4	49.8	78.6
7.6	3.0	53.0	69.6	87.6	66.7

Subtract:

7.	**8.**	**9.**	**10.**	**11.**
116.3	631.7	1535.0	950.3	141.6
86.5	570.9	980.6	262.4	87.9

Multiply or divide:

12.	**13.**	**14.**	**15.**	**16.**
87.9	94.6	68.7	76.9	75.8
5	7	9	6	8

17. $4\overline{)303.6}$ **18.** $6\overline{)298.2}$ **19.** $9\overline{)336.6}$ **20.** $7\overline{)523.6}$

21. $8\overline{)598.4}$ **22.** $8\overline{)552.8}$ **23.** $9\overline{)628.2}$ **24.** $7\overline{)675.5}$

GROWTH TEST

1. Add $\frac{1}{4}$ and $\frac{3}{4}$.

2. Multiply 678 by 8.

3. $2\frac{3}{8} - 2\frac{1}{8} =$?

4. $\frac{2}{3} + \frac{2}{3} =$?

5. Add 54.7, 59.9 and 88.7.

6. 2053 minus 1764 equals ?.

7. $690 \times 60 =$?

8. $\frac{2}{5}$ of 4850 is ?.

9. $3 \times 46.9 =$?

10. $\frac{1}{3} + \frac{1}{4} =$?

11. $1 - \frac{1}{2} =$?

12. $7\overline{)596.4}$

13. $16.1 - 9.4 =$?

14. $3\frac{1}{5} - 1\frac{2}{5} =$?

15. $36\overline{)3021}$

16. Average 68, 139, 102, 64, and 58.

17. Average 765, 767, 877, and 595.

18. The difference between 1710 and 983 is ?.

19. The product of 689 and 47 is ?.

BECOMING SURE AND QUICK

MEANING, TERMS, ABBREVIATIONS

Set 1. Meaning of Numbers

1. Use each digit only once to write the largest number you can:

a. 6, 8, 7, 3 **b.** 1, 5, 3, 7 **c.** 5, 9, 4, 9, 8

2. In which number does the 4 stand for most?

485 9548 14,632 62,549

3. Write ninety thousand, two hundred thirty-six.
4. Write one million, twelve thousand, eighty-four.
5. Write the largest 3-digit even number you can.

Set 2. Terms

Write the number in the box which is:

a. a sum
b. a product
c. a quotient
d. a multiplier
e. a minuend
f. a subtrahend
g. a dividend
h. a multiplicand
i. a divisor
j. a difference

$$\begin{array}{r} 6 \\ 7 \\ \underline{4} \\ 17 \end{array} \qquad \begin{array}{r} 983 \\ \underline{-649} \\ 334 \end{array}$$

$$5\overline{)45}^{\,9} \qquad \begin{array}{r} 22 \\ \underline{\times 3} \\ 66 \end{array}$$

Set 3. Abbreviations

Write these amounts using the whole names:

1. 4 lb.	**5.** 2 min.	**9.** 2 yr.	**13.** 2 bu.	**17.** 5 qt.
2. 6 yd.	**6.** 6 ft.	**10.** 8 oz.	**14.** 3 pr.	**18.** 3 mo.
3. 8 pt.	**7.** 5 doz.	**11.** 3 mi.	**15.** 9 in.	**19.** 4 gal.
4. 5 da.	**8.** 1 pk.	**12.** 4 hr.	**16.** 4 wk.	**20.** 68°

▶ MULTIPLICATION AND DIVISION

Set 1. Understanding Multiplication

1. Estimate the nearest answer. Multiply to check.

a.	$4 \times 110 =$	44	400	450	4500
b.	$9 \times 210 =$	180	190	1800	1900
c.	$12 \times 29 =$	300	350	1200	2900
d.	$49 \times 52 =$	200	250	2000	2500
e.	$99 \times 101 =$	900	1000	9000	10,000

2. No pencils, please. Choose the multiplication in **(a)** and in **(b)** that will have the largest product:

a. $\begin{array}{r}647\\ \underline{37}\end{array}$ $\begin{array}{r}529\\ \underline{37}\end{array}$ $\begin{array}{r}873\\ \underline{37}\end{array}$ **b.** $\begin{array}{r}427\\ \underline{53}\end{array}$ $\begin{array}{r}427\\ \underline{51}\end{array}$ $\begin{array}{r}427\\ \underline{52}\end{array}$

3. No pencils, please. Choose the division in **(a)** and in **(b)** that will have the largest quotient:

a. $44\overline{)1872}$ $54\overline{)1872}$ $39\overline{)1872}$ $46\overline{)1872}$

b. $28\overline{)2072}$ $28\overline{)2212}$ $28\overline{)2380}$ $28\overline{)2016}$

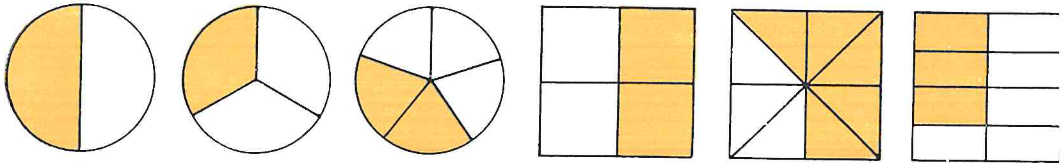
Set 2. Multiplication

	a	b	c	d
1.	$3 \times \$79.46$	$5 \times \$86.47$	$9 \times \$62.95$	$9 \times \$37.48$
2.	$4 \times \$58.37$	$8 \times \$96.75$	$7 \times \$35.79$	$6 \times \$68.39$
3.	$7 \times \$86.49$	$6 \times \$47.95$	$5 \times \$65.89$	$8 \times \$64.89$

Set 3. Division

1. $4\overline{)3860}$	**4.** $3\overline{)2904}$	**7.** $8\overline{)4696}$	**10.** $6\overline{)2148}$
2. $9\overline{)6714}$	**5.** $6\overline{)3072}$	**8.** $7\overline{)6055}$	**11.** $9\overline{)3465}$
3. $5\overline{)4890}$	**6.** $4\overline{)3348}$	**9.** $8\overline{)3752}$	**12.** $7\overline{)3353}$

FRACTIONS



A B C D E F

1. What fraction is colored in each figure above?

2. How many eighths of D are colored? of A?

3. How many sixths of B are colored?

4. Can you tell how many sixths of D are colored?

5. What is the sum of the colored parts of $D + E$? of $E + F$? of $D + F$?

6. Which fraction is the larger in each pair?

a. $\frac{1}{2}$ or $\frac{1}{3}$	**d.** $\frac{3}{8}$ or $\frac{5}{8}$	**g.** $\frac{2}{5}$ or $\frac{5}{10}$	**j.** $\frac{2}{3}$ or $\frac{3}{4}$
b. $\frac{1}{5}$ or $\frac{1}{8}$	**e.** $\frac{3}{5}$ or $\frac{3}{6}$	**h.** $\frac{3}{6}$ or $\frac{2}{3}$	**k.** $\frac{3}{4}$ or $\frac{4}{5}$
c. $\frac{1}{6}$ or $\frac{1}{4}$	**f.** $\frac{4}{7}$ or $\frac{4}{9}$	**i.** $\frac{2}{4}$ or $\frac{5}{8}$	**l.** $\frac{4}{5}$ or $\frac{9}{10}$

7. Change these fractions as called for:

a. $\frac{1}{4} = \frac{?}{8}$	**d.** $\frac{6}{12} = \frac{?}{2}$	**g.** $\frac{1}{4} = \frac{?}{8}$	**j.** $\frac{12}{16} = \frac{?}{4}$
b. $\frac{2}{3} = \frac{?}{6}$	**e.** $\frac{4}{5} = \frac{?}{10}$	**h.** $\frac{3}{12} = \frac{?}{4}$	**k.** $\frac{5}{10} = \frac{?}{2}$
c. $\frac{6}{8} = \frac{?}{4}$	**f.** $\frac{1}{3} = \frac{?}{6}$	**i.** $\frac{3}{8} = \frac{?}{16}$	**l.** $\frac{8}{12} = \frac{?}{3}$

Find the answers for these examples. Watch the signs.

	a	b	c	d	e
8.	$\frac{1}{2} + \frac{1}{4}$	$\frac{3}{8} + \frac{5}{8}$	$\frac{1}{2} - \frac{1}{4}$	$1\frac{1}{3} - \frac{2}{3}$	$\frac{1}{2} + \frac{1}{3}$
9.	$\frac{1}{8} + \frac{1}{4}$	$\frac{3}{5} + \frac{4}{5}$	$\frac{7}{8} - \frac{3}{8}$	$1\frac{1}{2} - \frac{3}{4}$	$\frac{1}{5} + \frac{1}{2}$
10.	$\frac{3}{8} + \frac{1}{2}$	$\frac{1}{2} + \frac{3}{4}$	$1 - \frac{2}{5}$	$2\frac{1}{5} - 1\frac{3}{5}$	$\frac{2}{3} + \frac{1}{4}$

FRACTIONS (continued)

Set 1. Addition

1. $\begin{array}{r}\frac{1}{5}\\ \underline{\frac{2}{5}}\end{array}$	**2.** $\begin{array}{r}\frac{1}{3}\\ \underline{\frac{1}{6}}\end{array}$	**3.** $\begin{array}{r}\frac{3}{8}\\ \underline{\frac{5}{8}}\end{array}$	**4.** $\begin{array}{r}\frac{4}{5}\\ \underline{\frac{3}{5}}\end{array}$	**5.** $\begin{array}{r}1\frac{1}{2}\\ \underline{\frac{3}{4}}\end{array}$	**6.** $\begin{array}{r}2\frac{2}{3}\\ \underline{1\frac{5}{6}}\end{array}$
7. $\begin{array}{r}2\frac{3}{8}\\ \underline{1\frac{7}{8}}\end{array}$	**8.** $\begin{array}{r}3\frac{3}{4}\\ \underline{\frac{3}{4}}\end{array}$	**9.** $\begin{array}{r}1\frac{1}{2}\\ \underline{1\frac{5}{6}}\end{array}$	**10.** $\begin{array}{r}2\\ \underline{3\frac{3}{5}}\end{array}$	**11.** $\begin{array}{r}2\frac{2}{5}\\ \underline{1\frac{3}{5}}\end{array}$	**12.** $\begin{array}{r}1\frac{2}{3}\\ \underline{2\frac{2}{6}}\end{array}$

Set 2. Subtraction

1. $\begin{array}{r}\frac{3}{5}\\ \underline{\frac{1}{5}}\end{array}$	**2.** $\begin{array}{r}\frac{3}{4}\\ \underline{\frac{1}{4}}\end{array}$	**3.** $\begin{array}{r}\frac{3}{4}\\ \underline{\frac{1}{2}}\end{array}$	**4.** $\begin{array}{r}\frac{9}{10}\\ \underline{\frac{2}{5}}\end{array}$	**5.** $\begin{array}{r}1\frac{5}{6}\\ \underline{\frac{1}{2}}\end{array}$	**6.** $\begin{array}{r}2\frac{2}{3}\\ \underline{1\frac{1}{6}}\end{array}$
7. $\begin{array}{r}\frac{1}{6}\\ \underline{\frac{1}{6}}\end{array}$	**8.** $\begin{array}{r}3\frac{1}{4}\\ \underline{1\frac{1}{4}}\end{array}$	**9.** $\begin{array}{r}2\frac{7}{8}\\ \underline{1\frac{1}{4}}\end{array}$	**10.** $\begin{array}{r}3\frac{3}{10}\\ \underline{2\frac{1}{5}}\end{array}$	**11.** $\begin{array}{r}1\frac{4}{5}\\ \underline{1\frac{2}{5}}\end{array}$	**12.** $\begin{array}{r}2\frac{5}{6}\\ \underline{2\frac{1}{3}}\end{array}$

Set 3. Addition (including unrelated denominators)

1. $\begin{array}{r}\frac{1}{2}\\ \underline{\frac{3}{4}}\end{array}$	**2.** $\begin{array}{r}\frac{2}{3}\\ \underline{\frac{5}{6}}\end{array}$	**3.** $\begin{array}{r}1\frac{1}{6}\\ \underline{\frac{7}{12}}\end{array}$	**4.** $\begin{array}{r}2\frac{3}{4}\\ \underline{\frac{5}{12}}\end{array}$	**5.** $\begin{array}{r}1\frac{2}{3}\\ \underline{1\frac{1}{3}}\end{array}$	**6.** $\begin{array}{r}1\frac{1}{6}\\ \underline{2\frac{1}{6}}\end{array}$
7. $\begin{array}{r}\frac{1}{2}\\ \underline{\frac{1}{3}}\end{array}$	**8.** $\begin{array}{r}2\frac{1}{3}\\ \underline{\frac{1}{4}}\end{array}$	**9.** $\begin{array}{r}1\frac{1}{2}\\ \underline{2\frac{2}{5}}\end{array}$	**10.** $\begin{array}{r}\frac{2}{3}\\ \underline{\frac{3}{4}}\end{array}$	**11.** $\begin{array}{r}1\frac{1}{2}\\ \underline{\frac{2}{3}}\end{array}$	**12.** $\begin{array}{r}2\frac{3}{4}\\ \underline{2\frac{1}{3}}\end{array}$

Set 4. Subtraction (including unrelated denominators)

1. $\begin{array}{r}1\\ \underline{\frac{2}{3}}\end{array}$	**2.** $\begin{array}{r}2\\ \underline{1\frac{1}{4}}\end{array}$	**3.** $\begin{array}{r}\frac{3}{4}\\ \underline{\frac{1}{3}}\end{array}$	**4.** $\begin{array}{r}\frac{3}{5}\\ \underline{\frac{1}{2}}\end{array}$	**5.** $\begin{array}{r}\frac{4}{3}\\ \underline{\frac{1}{2}}\end{array}$	**6.** $\begin{array}{r}\frac{3}{2}\\ \underline{\frac{6}{5}}\end{array}$
7. $\begin{array}{r}3\frac{2}{3}\\ \underline{\frac{1}{2}}\end{array}$	**8.** $\begin{array}{r}2\frac{1}{2}\\ \underline{\frac{4}{5}}\end{array}$	**9.** $\begin{array}{r}2\frac{3}{4}\\ \underline{2\frac{1}{3}}\end{array}$	**10.** $\begin{array}{r}3\frac{1}{2}\\ \underline{1\frac{2}{3}}\end{array}$	**11.** $\begin{array}{r}2\frac{2}{3}\\ \underline{1\frac{3}{4}}\end{array}$	**12.** $\begin{array}{r}3\frac{1}{3}\\ \underline{2\frac{1}{2}}\end{array}$

DIVISION

Set 1. For use with an answer strip

Number an answer strip to 36. Write only the whole number in the answer. *Example*: 2's in 7 = 3

(1)	(7)	(13)	(19)	(25)	(31)
3's in 22	3's in 26	5's in 44	8's in 75	4's in 31	8's in 53
8's in 33	4's in 14	9's in 57	6's in 40	8's in 46	9's in 68
9's in 85	7's in 30	4's in 27	3's in 25	7's in 54	6's in 44
4's in 23	3's in 20	8's in 60	5's in 32	5's in 49	4's in 35
9's in 50	9's in 40	9's in 65	3's in 28	8's in 66	7's in 60
5's in 28	4's in 18	6's in 47	7's in 40	4's in 37	9's in 57

Set 2

Divide and check:

1. $32\overline{)768}$	**2.** $54\overline{)5184}$	**3.** $92\overline{)3220}$	**4.** $72\overline{)3816}$
5. $64\overline{)3072}$	**6.** $83\overline{)7225}$	**7.** $75\overline{)3525}$	**8.** $93\overline{)6324}$
9. $46\overline{)23276}$	**10.** $68\overline{)50320}$	**11.** $59\overline{)17995}$	**12.** $87\overline{)8352}$
13. $98\overline{)69482}$	**14.** $76\overline{)74480}$	**15.** $68\overline{)24480}$	**16.** $79\overline{)47716}$

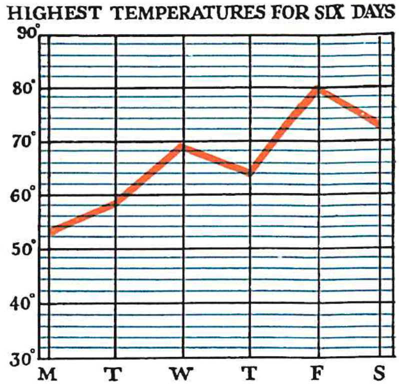
Set 3

Divide and check:

1. $47\overline{)2456}$	**2.** $85\overline{)4121}$	**3.** $94\overline{)3679}$	**4.** $75\overline{)2715}$
5. $69\overline{)24150}$	**6.** $76\overline{)31008}$	**7.** $83\overline{)66898}$	**8.** $94\overline{)44180}$
9. $26\overline{)1497}$	**10.** $18\overline{)637}$	**11.** $37\overline{)2943}$	**12.** $59\overline{)5753}$
13. $28\overline{)1389}$	**14.** $49\overline{)4239}$	**15.** $27\overline{)1850}$	**16.** $38\overline{)2985}$

CHARTS AND TABLES

LINE GRAPH



1. Which day was warmest?

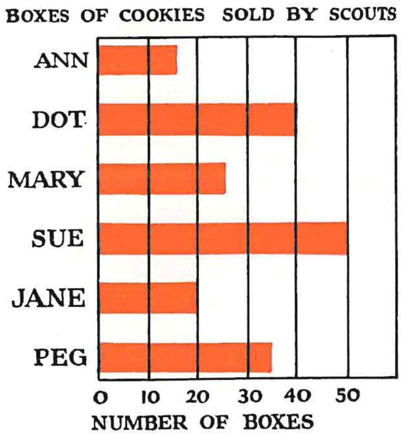
2. Which days were not as warm as Wednesday?

3. How high was the temperature on Tuesday? on Saturday?

4. When was the highest temperature 60°? 80°?

5. Which days were not as warm as the day before?

BAR GRAPH



1. Who sold the most? next most? fewest?

2. How many boxes did Dot sell? Peg?

3. Who sold just 20? 25?

4. Sue sold how many more than Ann sold?

5. How many did Dot and Jane sell together?

READING A TABLE

1. How many miles is it from Detroit to Denver? New York to Miami? Los Angeles to Boston? Seattle to Chicago? Miami to Houston? St. Louis to Boston?

2. Which two cities are nearest each other?

MILES BETWEEN UNITED STATES CITIES

	Boston	Miami	Denver	Seattle
Chicago	990	1400	1000	2120
Detroit	720	1380	1315	2230
Houston	1895	1220	1035	2365
Los Angeles	3085	2820	1170	1180
New York	215	1340	1795	2985
St. Louis	1160	1265	875	2175

ONE-STEP PROBLEMS

1. How much more money does Harry need? He wants to buy a radio from a friend for $8.00. Harry now has $4.85.

2. What is the equal share of the cost of a party for each of 4 girls? The total cost is $2.60.

3. Bill is 4 ft. 10 in. tall. How many inches tall is he?

4. How many rabbits have Jack and Rose together? Jack has 14 rabbits. Rose has 8. Barbara has 20. She has nearly as many as both Jack and Rose have.

5. The car miles showed 5242 when Art started a trip. The car miles now read 5446. How far has the car gone since Art started?

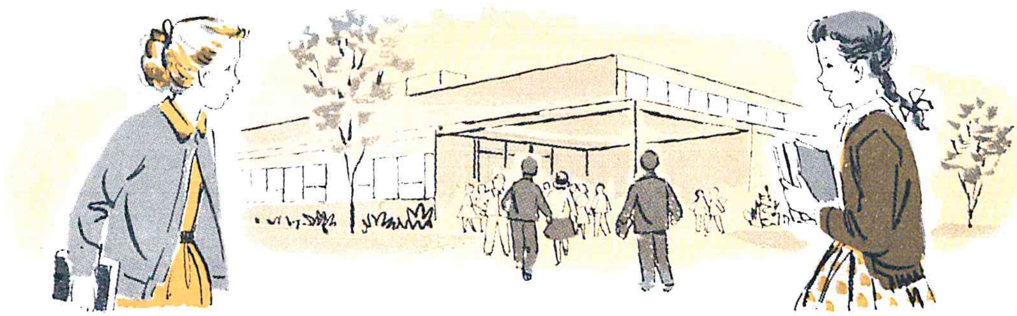
6. What is the total cost of 12 candy bars at 8¢ each?

7. How much does one ball cost when balls sell for $7.50 a half dozen?

8. How many papers did George carry in 3 days? He took 37 on Tuesday, 26 on Wednesday, and 34 on Thursday.

9. A gross of pencils is 144. Mrs. Johnson has ordered $\frac{1}{2}$ gross for the class. How many pencils is $\frac{1}{2}$ gross?

10. The pupil who lives farthest from school is $4\frac{1}{2}$ miles away. The one who lives nearest is $\frac{1}{2}$ mile away, and in the same direction. How far apart do these two pupils live?



TWO-STEP PROBLEMS

1. How much change should Carol receive from $1? She is buying 2 combs at 29¢ each.

2. How much farther have we to go to the mountains? The whole distance is 225 mi. and we have come 60 mi. to White City and 45 mi. more to Colton. We are now at Colton.

3. What is each girl's share for the party? Nine girls shared the cost of $3.25 for food and $1.25 for other expenses.

4. How many 18-inch ribbons can Martha get from 10 yards of ribbon?

5. Jerry spent $1.20 for seeds, $1.50 for fertilizer, and $2.15 for garden tools. He has sold vegetables for $3.25. How much more must he sell to equal expenses?

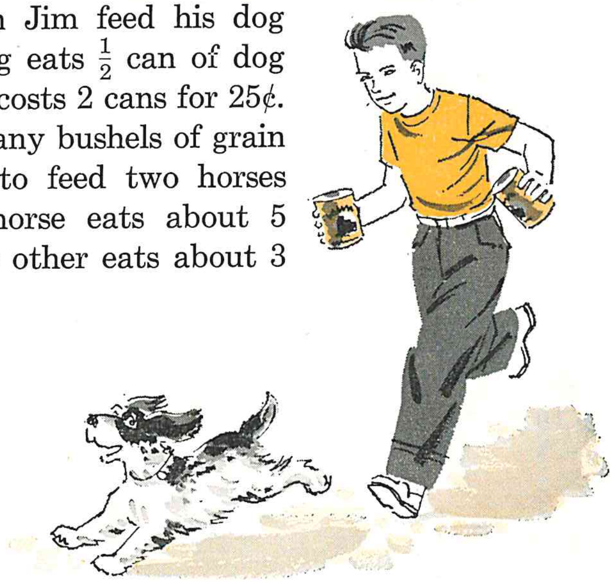
6. About how many hours does Linda watch television in a week? She says she watches it 90 min. a day.

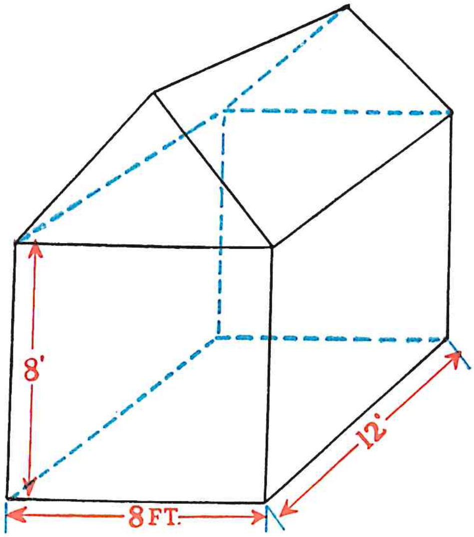
7. Bill and his family left home at 1:15 P.M. It is now a quarter after 3 P.M. They have gone 80 miles. How many miles an hour have they averaged?

8. Mr. Brown's pace of two steps is 5 ft. How many paces will he take to step off 100 yd.?

9. How long can Jim feed his dog for a dollar? The dog eats $\frac{1}{2}$ can of dog food daily. The food costs 2 cans for 25¢.

10. About how many bushels of grain will it take for Joe to feed two horses during June? One horse eats about 5 quarts a day and the other eats about 3 quarts.





MEASURING AREA

Mike and Larry are planning to build a hut. The floor space is 8′ × 12′. The sides are 8′ high.

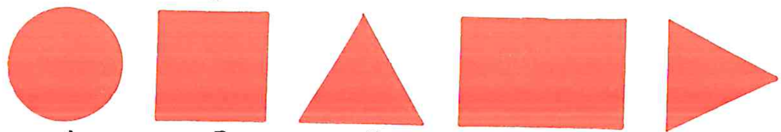
1. How many pieces of wallboard 4′ × 8′ will be needed to make a side?

2. How many pieces will be needed to make the front if you don't count the triangle at the top?

3. What is the perimeter of the floor?

4. How many square feet of floor space will there be in the hut?

5. Name the figures below:



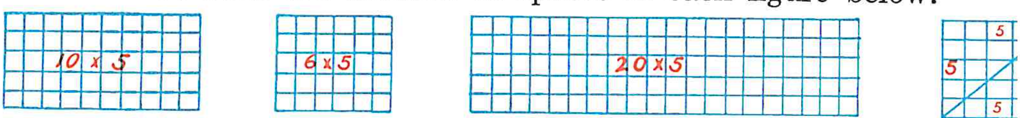
A B C D E

6. How many square feet are in each of these areas?

a. 30′ × 10′ **c.** 12′ × 6′ **e.** 15′ × 6′
b. 6′ × 18′ **d.** 6′ × 4′ **f.** 4 yd. × 5 yd.

7. What is the perimeter of:
a. a square if one side is 8 ft.?
b. a triangle if the sides are 8, 6, and 9 ft.?
c. a rectangle if two sides are 8′ and 5′?

8. Find the number of spaces in each figure below:



A B C D

DECIMAL FRACTIONS

Set 1

1. Write these numbers as mixed decimals:

   a. $5\frac{3}{10}$ **b.** $35\frac{8}{10}$ **c.** $40\frac{9}{10}$ **d.** $16\frac{75}{100}$ **e.** $42\frac{65}{100}$

2. Choose the best answer by estimating:

a. \$ 75.00 ÷ 4 =	\$1.87	\$18.75	\$187.50
b. \$380.00 ÷ 8 =	\$0.47	\$ 4.75	\$ 47.50
c. \$ 6.25 ÷ 5 =	\$1.25	\$12.50	\$125
d. \$453.00 ÷ 3 =	\$1.51	\$15.10	\$151.00

3. Add 1.23 in., .45 in., 3.10 in., and .07 in.
4. Subtract .46 from 1.24.
5. Multiply 4.5 by 4.
6. Multiply 3.25 by 8.

Set 2

Multiply:

1. $\begin{array}{r} 46.9 \\ 5 \\ \hline \end{array}$	**2.** $\begin{array}{r} 94.8 \\ 2 \\ \hline \end{array}$	**3.** $\begin{array}{r} 85.7 \\ 4 \\ \hline \end{array}$	**4.** $\begin{array}{r} 48.5 \\ 3 \\ \hline \end{array}$	**5.** $\begin{array}{r} 48.5 \\ 6 \\ \hline \end{array}$
6. $\begin{array}{r} 68.3 \\ 9 \\ \hline \end{array}$	**7.** $\begin{array}{r} 93.5 \\ 7 \\ \hline \end{array}$	**8.** $\begin{array}{r} 79.6 \\ 3 \\ \hline \end{array}$	**9.** $\begin{array}{r} 48.5 \\ 8 \\ \hline \end{array}$	**10.** $\begin{array}{r} 39.6 \\ 4 \\ \hline \end{array}$
11. $\begin{array}{r} 64.8 \\ 7 \\ \hline \end{array}$	**12.** $\begin{array}{r} 57.4 \\ 9 \\ \hline \end{array}$	**13.** $\begin{array}{r} 69.7 \\ 6 \\ \hline \end{array}$	**14.** $\begin{array}{r} 76.9 \\ 8 \\ \hline \end{array}$	**15.** $\begin{array}{r} 83.7 \\ 5 \\ \hline \end{array}$

Set 3

Divide:

1. $3\overline{)7.5}$	**2.** $5\overline{)48.5}$	**3.** $8\overline{)67.2}$	**4.** $7\overline{)52.5}$
5. $6\overline{)57.0}$	**6.** $9\overline{)77.4}$	**7.** $7\overline{)34.3}$	**8.** $5\overline{)42.5}$
9. $8\overline{)55.2}$	**10.** $4\overline{)34.8}$	**11.** $6\overline{)28.8}$	**12.** $9\overline{)42.3}$

MEASURES

Use an answer sheet:

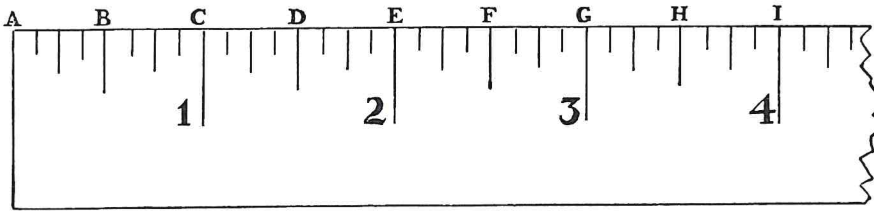
1. Write the units of measure in each group in order from the smallest to the largest:

a. gallon	$\frac{1}{2}$ pint	quart	pint
b. foot	mile	inch	yard

2. Choose the answer that is nearest the correct one:

a. The length of this book is
about 9 ft. about 9 yd. about 9 in.

b. The width of our classroom is
about 30 ft. about 20 yd. about 120 in.



3. How many inches is it from the left end of the ruler to the line *C*? to line *F*?

4. How many inches is it:

a. from *C* to *G*?
b. from *C* to *F*?
c. from *C* to *D*?
d. from *B* to *E*?

5. The scales at the right show __?__ lb.

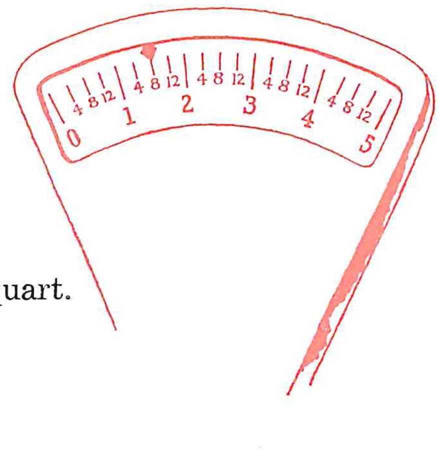
6. $\frac{1}{2}$ lb. of butter = __?__ oz.

7. $\frac{3}{4}$ lb. of meat = __?__ oz.

8. A quart of milk will fill __?__ $\frac{1}{2}$-pint bottles.

9. A gallon of punch is __?__ times as much as a quart.

10. A pint is __?__ as much as a quart.



▶ TIME

1. What time does the watch show?
2. The Safety Patrol boys must be at the street crossing at 2:45. It takes them 5 minutes to put on their caps and sweaters and 5 minutes to walk to the crossing. At what time should they start to put on their caps and sweaters?
3. Would they be on duty at 2:45 A.M. or 2:45 P.M.?
4. They should stay at the crossing for 20 minutes. At what time should they leave to return to school?
5. At what time should they arrive at school?
6. About how long are they away from school?
7. What part of an hour is:
   a. 15 minutes? **b.** 30 minutes? **c.** 45 minutes?

GROWTH TEST

1. Find the product of 7 and 478.
2. Find the average of 156, 78, 89, 79, and 167.
3. What is the difference between 9600 and 2864?
4. The sum of $\frac{2}{3}$, $\frac{1}{2}$, and $\frac{1}{4}$ is ___?___.
5. Average 869, 697, 947 and 896.
6. 3139 minus 2787 equals ___?___.
7. 89 times 457 equals ___?___.
8. Add $\frac{1}{6}$, $\frac{3}{6}$, and $\frac{2}{6}$.
9. Take $\frac{2}{5}$ from $1\frac{3}{5}$.
10. Find the sum of $\frac{3}{4}$ and $\frac{3}{4}$.
11. Add 65.5, 58.9, and 46.8.
12. $2\frac{5}{8} + 3\frac{3}{4} =$ ___?___
13. Multiply 907 by 60.
14. $\frac{3}{4}$ of 3872 = ___?___
15. $4 \times 47.5 =$ ___?___
16. Subtract $2\frac{1}{2}$ from $3\frac{3}{4}$.
17. $268.8 \div 3 =$ ___?___
18. $22.5 - 8.6 =$ ___?___
19. $2\frac{3}{8}$ less $1\frac{1}{2}$ equals ___?___.
20. $58\overline{)4030}$

Set 1. Multiplication

Test A

Teacher: This test should be duplicated. (If duplicator is not available, have pupils copy it one day and take it the next.) The test includes facts of 3's through 9's.

Have children record the time taken.

1. 357 4	**2.** 869 3	**3.** 586 7	**4.** 968 4	**5.** 457 9	**6.** 847 6
7. 578 8	**8.** 986 5	**9.** 468 9	**10.** 489 7	**11.** 659 9	**12.** 697 6
13. 689 8	**14.** 679 5	**15.** 796 7	**16.** 879 9	**17.** 695 8	**18.** 685 6

Test B

Have pupils number an answer strip 1–32. Use a watch with a second hand. Begin to say a new item on each 5-second interval. Say, "Write only the answer. If you do not know the answer, draw a line and mark the next answer in the next space. Are you ready?"

(1)
5 sevens
6 fours
7 sixes
8 eights
9 fours
5 sixes
4 eights

(8)
6 sevens
7 nines
8 fives
9 sevens
5 nines
4 sixes
9 eights

(15)
6 fives
7 fours
8 nines
9 sixes
4 sevens
5 eights

(21)
6 sixes
7 eights
9 fives
8 sevens
9 nines
6 eights

(27)
7 fives
4 nines
8 sixes
6 nines
7 sevens
8 fours

FIRST TESTS FOR THE EXPERIMENT (page 53)

Test C

Have pupils number an answer strip 1–35. Follow the same directions as for Test B.

(1)	(8)	(15)	(22)	(29)
48 and 2	63 and 7	54 and 7	45 and 6	36 and 4
56 and 4	49 and 3	48 and 3	72 and 8	48 and 8
54 and 8	54 and 6	56 and 5	64 and 6	56 and 7
49 and 6	48 and 4	63 and 8	48 and 5	49 and 4
36 and 7	64 and 7	49 and 5	56 and 6	35 and 6
45 and 5	35 and 5	36 and 8	49 and 2	45 and 8
48 and 6	49 and 1	48 and 7	45 and 7	36 and 5

Set 2. Multiplication

(Optional. Tests difficult carry facts.)

1. $\begin{array}{r}345\\ \underline{9}\end{array}$	**2.** $\begin{array}{r}287\\ \underline{6}\end{array}$	**3.** $\begin{array}{r}249\\ \underline{9}\end{array}$	**4.** $\begin{array}{r}688\\ \underline{8}\end{array}$
5. $\begin{array}{r}456\\ \underline{9}\end{array}$	**6.** $\begin{array}{r}759\\ \underline{7}\end{array}$	**7.** $\begin{array}{r}578\\ \underline{9}\end{array}$	**8.** $\begin{array}{r}365\\ \underline{8}\end{array}$
9. $\begin{array}{r}573\\ \underline{7}\end{array}$	**10.** $\begin{array}{r}357\\ \underline{9}\end{array}$	**11.** $\begin{array}{r}377\\ \underline{8}\end{array}$	**12.** $\begin{array}{r}269\\ \underline{9}\end{array}$
13. $\begin{array}{r}789\\ \underline{8}\end{array}$	**14.** $\begin{array}{r}368\\ \underline{9}\end{array}$	**15.** $\begin{array}{r}267\\ \underline{8}\end{array}$	**16.** $\begin{array}{r}467\\ \underline{9}\end{array}$
17. $\begin{array}{r}678\\ \underline{8}\end{array}$	**18.** $\begin{array}{r}479\\ \underline{9}\end{array}$	**19.** $\begin{array}{r}789\\ \underline{7}\end{array}$	**20.** $\begin{array}{r}589\\ \underline{9}\end{array}$

FINAL TESTS FOR THE EXPERIMENT

(Closing on page 68)

Set 1. Multiplication

Test A

Teacher: This test should be duplicated. (If duplicator is not available, have pupils copy it one day and take it the next day.) The test includes facts of 3's through 9's. Many difficult facts are repeated.

Have children record the time taken.

1. 537	2. 869	3. 968	4. 486	5. 467	6. 784
4	3	4	7	9	6
7. 675	8. 698	9. 958	10. 789	11. 678	12. 698
8	5	9	7	9	6
13. 789	14. 796	15. 596	16. 954	17. 569	18. 675
8	5	7	9	8	6

Test B

Have pupils number an answer strip 1–32. Use a watch with a second hand. Begin to say a new item on each 5-second interval. Say, "Write only the answer. If you do not know the answer, draw a line and mark the next answer in the next space. Are you ready?"

(1)
6 fours
4 eights
7 fives
8 nines
5 sixes
4 sevens
6 nines

(8)
8 fours
7 sevens
6 sixes
4 nines
8 fives
9 eights
4 sixes

(15)
6 eights
9 fours
7 sixes
5 eights
7 fours
5 nines

(21)
9 sevens
8 sixes
9 fives
5 sevens
7 nines
8 sevens

(27)
9 sixes
6 sevens
8 eights
9 nines
6 fives
7 eights

Test C

Have pupils number an answer strip 1–35. Follow the same directions as for Test B.

(1)	(8)	(15)	(22)	(29)
45 and 6	63 and 8	48 and 7	48 and 5	72 and 8
48 and 3	36 and 6	36 and 4	35 and 6	49 and 5
56 and 4	54 and 7	45 and 5	49 and 3	54 and 6
35 and 5	49 and 4	54 and 8	45 and 8	45 and 7
49 and 1	36 and 7	49 and 6	64 and 6	36 and 5
56 and 7	49 and 2	36 and 8	56 and 5	48 and 6
48 and 4	56 and 6	63 and 7	48 and 2	64 and 7

Set 2. Multiplication

(Optional. Tests difficult carry facts.)

1. 589 9	**2.** 267 8	**3.** 479 9	**4.** 678 8
5. 345 9	**6.** 287 6	**7.** 249 9	**8.** 688 8
9. 467 9	**10.** 789 7	**11.** 368 9	**12.** 789 8
13. 573 7	**14.** 357 9	**15.** 377 8	**16.** 269 9
17. 365 8	**18.** 578 9	**19.** 759 7	**20.** 456 9

MEASURES AND NAMES WE SHOULD KNOW

LENGTH

12 inches (in.) (″) = 1 foot (ft.) (′)
36 inches (in.) = 1 yard (yd.)
3 feet (ft.) = 1 yard
5280 feet = 1 mile (mi.)

NUMBER MEASURES

2 things = 1 pair (pr.)
12 things = 1 dozen (doz.)
$\frac{1}{2}$ thing = 1 half
$\frac{1}{4}$ thing = 1 quarter

LIQUID MEASURE

2 cups = 1 pint (pt.)
2 pints (pt.) = 1 quart (qt.)
4 quarts (qt.) = 1 gallon (gal.)
8 pints (pt.) = 1 gallon (gal.)

DRY MEASURE

2 pints (pt.) = 1 quart (qt.)
8 quarts (qt.) = 1 peck (pk.)
4 pecks = 1 bushel (bu.)

MEASURES OF WEIGHT

16 ounces (oz.) = 1 pound (lb.)
2000 pounds (lb.) = 1 ton (T.)

UNITED STATES MONEY

Decimal Units
1 cent (¢) = one cent
10 cents (¢) = one dime
10 dimes = one dollar ($)

Five cents = 1 nickel
2 nickels = 1 dime
5 nickels = 1 quarter dollar
4 quarters = 1 dollar
2 half dollars = 1 dollar

MEASURES OF TIME

60 seconds (sec.) = 1 minute
60 minutes (min.) = 1 hour
24 hours (hr.) = 1 day
7 days (da.) = 1 week

28, 29, 30, or 31 days = 1 month
12 months (mo.) = 1 year (yr.)
365 days = 1 year (yr.)
366 days = 1 leap year

DECIMAL SYSTEM

Ten Thousands	Thousands	Hundreds	Tens	Ones or Units
2	2,	2	2	2

ROMAN NUMERALS

I	1	VI	6	XII	12
II	2	VII	7	XIII	13
III	3	VIII	8	XV	15
IV	4	IX	9	XIX	19
IIII	4	X	10	XX	20
V	5	XI	11	XXI	21

FLAT SHAPES

circle	○
square	□
triangle	△
rectangle	▭

This page here—Page 320—is the last in this arithmetic book; up to 7 more pages would have applied (including the index). The back cover is also left out purposely.